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JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

THE NEW AGRICULTURAL POLICY AND THE DAIRY FARMING INDUSTRY.

INTRODUCTION.

IT is intended in the following pages to discuss at some length the probable effects on the dairy farming industry of the new agricultural policy forced on this country by the circumstances of the war. The aim of this policy is briefly to encourage and increase the production of food at home, so that this country in the future may be rendered much less dependent on supplies imported from abroad. This policy, which is yet in the earliest stages of development, requires primarily a great increase in the production of cereals, especially wheat, and this end can only be attained by bringing under arable cultivation a very large acreage of land which is to-day under permanent grass. At the same time the present level of production of other essential foods which by their nature must be entirely produced at home, or others which are to a certain extent imported, must be maintained and if possible increased. Of such foods, those produced by the dairy farmer—milk, cheese and butter—are amongst the most important. In the case of milk we have a food which occupies a unique position For infants and children it is the one indispensable food, and cannot be generally and satisfactorily replaced by any other substance; also, by reason of its perishable nature, it cannot be imported satisfactorily from any other country. In spite of the increased importations of condensed and dried milk we must for many years be almost entirely dependent on our home-produced supplies. In addition to the value of milk itself, the products made from it—cheese and butter—are of prime importance as food for all classes of the population.

Previous to the war, it was estimated that the total annual production of milk in Great Britain was about 1,250 million gallons; of this total some 73 per cent. was consumed as new milk, representing a total of nearly 900 million gallons (if valued at 1s. per gallon—45,000,000*l.*), and even this immense volume did not meet the demands or the needs of the population. The remainder of the milk—27 per cent.—was manufactured into butter, cheese, &c., but the products thus obtained represented but a fraction of the total annual national consumption. In respect of cheese the amount produced at home was some 22 per cent., and as regards butter some 30 per cent. of the national requirements; the balance was imported from our colonies or from foreign countries, and at the prices ruling in 1914 this represented a total value of over 30,000,000*l.* It is clearly evident, therefore, that the milk and dairy produce are of great importance in the national food supply.

It will also be granted that it is impossible to develop one branch of farming to a much greater extent than hitherto without affecting to a greater or lesser extent every other branch, hence, it is most important in the interests not only of the dairy farmer, but of all associated with the dairy industry and of the nation at large to consider how and in what directions changes may be induced by the new agricultural policy in the practice of dairy farming and in the production of milk and dairy produce in this country.

RELATION BETWEEN GRASS LAND AND DAIRY FARMING.

When as a result of the oft described depression in the price of all kinds of farm produce the arable land of the "seventies" of last century began to be laid down or to fall down to grass, some years elapsed before it was realised that milk production afforded a means whereby a living could be made on the heavy clay soils which had been formerly devoted to grain growing. The regular and frequent monetary returns obtainable acted as an inducement to many farmers to adopt milk production as the mainstay of their system of farming in spite of longer hours every day of the week and at all seasons of the year. During the last thirty years there has been a steady increase in the numbers of milking cows in this country, though this increase has not been proportionate to the increase in the population in the same period (see page 22), and dairy farming has come to be closely associated with, and sometimes considered to be absolutely dependent on, a large area of permanent grass land.

It is important to remember, however, that the increase in grass land was not brought about in the first instance by a desire to take up milk production. In some districts remote from towns and with poor railway services, much land was laid down to grass during the last thirty years without any appreciable increase in the numbers of cows, and had there been no depression, with its consequent decrease in the arable acreage, the increased demand for milk from London and other densely populated areas—a demand due both to a rapidly growing population and to a greater consumption per head—would still have brought about an increase in milk production.

While it is well known that the profitable utilisation of grass land is quite possible without a dairy herd, it is not so generally recognised that milk production may be very successfully practised on farms entirely under a rotation and with but a comparatively small area of pasture devoted to cows.

HOW DAIRY FARMING MAY BE AFFECTED.

A study of all aspects of the situation leads to the conclusion that the carrying out of the new policy must exercise a direct effect on the dairy farming industry by reducing the acreage of grass land at present devoted to milk production, and thus bringing about either a diminution in the number of cows kept, or a change in the system of feeding. The following indirect effects may also follow. Firstly, other systems of farming may become more remunerative or equally remunerative with less work and worry, and farmers will therefore be induced to give up milk production. Secondly, owing to the reduction in pasture and its consequences, and more assured returns from cereal crops, milk production may be greatly reduced in certain areas naturally adapted for grain growing, and most probably increased in others where the natural conditions enable milk to be produced most cheaply. Thirdly, it may be increasingly difficult for dairy farmers to obtain efficient labour, and any aggravation or even continuation of the present difficulties will lead to a reduction in the number and size of dairy herds. Each of these probable effects will now be discussed more fully.

EFFECT OF A DECREASE IN GRASS LAND.

During the past summer the statement that the ploughing up of a large acreage of grass land must bring about a reduction in the head of cows and in the output of milk has frequently appeared in the agricultural press, and been endorsed in the resolutions of many farmers' clubs and societies. It cannot be admitted that this is an accurate generalisation, though there may be instances of individual farms where it is correct.

Before proceeding further, however, it is desirable to point out that no hard and fast scale fixing the proportion of grass land to be broken up on all farms has been issued by the Board of Agriculture. Instead, the decision as to the acreage and the actual fields to be converted to arable on any farm has been left to the local War Agricultural Executive Committee, and these committees have been instructed to give careful consideration to local conditions, and to avoid any course of action which would inevitably lead to a curtailment of the milk supply.

Suggestions have been made in different districts as to the area of grass land required per cow, for instance, the Essex War Agricultural Committee was reported to have stated that in their opinion two acres of average grass per cow should be considered as sufficient in their district, and instances were known of successful dairy farming in the county with one to one and a half acres of grass per cow. But as the quality of the soil and herbage, the rainfall, and the number of young stock reared show great variations from farm to farm, it is undoubtedly preferable to avoid stating any fixed scale, and to leave the decision in each case to the local committees. There may be special instances, such as small farms of heavy clay soil entirely in grass, devoted solely to maintaining cows and without buildings or equipment for any alternative system, where it does not appear probable that the breaking up of a small acreage can give an adequate return. When such farms are located in densely populated districts, or on the outskirts of cities where there is a large demand for milk, there exists an added reason for hesitation in the introduction of the plough. Another set of circumstances, however, to be referred to later, arising out of Governmental action to meet the emergencies of the present time, are likely to exercise important effects on the system of management prevailing on this type of farm.

Apart from such special cases the statement that a reduction in the head of cows must follow from the ploughing up of an area of grass land must not be allowed to pass unchallenged.

The basis of this plea is that the acreage of summer grazing and the amount of hay for winter will be reduced, hence a reduction of the herd must follow, but this reasoning omits to take into consideration the relative quantities of food for cows which can be obtained per acre of grass land and per acre of arable The first point at issue is whether or not, by increasing the acreage of arable the food required to maintain the existing dairy herd can be grown, and at the same time a quantity of grain produced for direct human consumption. Provided that suitable and sufficient food can be grown, a second point which will undoubtedly rise is whether or not this can be done at a reasonable cost.

MAINTENANCE OF FOOD SUPPLIES FOR DAIRY HERDS.

In considering the first point it is important to keep a true sense of the proportion of the problem. It is not a question involving the whole milk supply for any city or county or even the output from any one farm. Any reduction in the acreage of grass can mean at most only a few cows less in the herd, and all that is necessary therefore is that the arable land should produce the foods required to maintain these cows during the summer and winter. There are numerous crops grown on arable land which can do all that is needed and it is generally recognised at the present time, that farms with a proportion of arable land will provide a greater variety of foods for both summer and winter use than a farm which is wholly in grass. The point that is not yet understood by many dairy farmers is that an increase in the acreage of arable land on a grass farm may give not only a greater variety of home grown foods, but will certainly give a greater quantity, and thus enable a larger head of stock to be carried, or, if the stock remain the same, will allow of the sale of grain for human food. The importance of this point is so great in relation to the maintenance of the output of milk, and to the increased production of cereals, that it is proposed to devote some pages to an examination of the methods whereby this result may be obtained.

Any increase in the proportion of arable to grass land on a farm, must bring about some change in the total amount of the various kinds of food produced. It is quite impossible to consider in detail all the forms which these changes may take, but it is self-evident that all will have the effect of reducing the area of pasture, and the area under meadow hay, and increasing the area devoted to cereals, fodders and root crops. Whether the stock-carrying capacity of the pasture, or the total yield of meadow hay be, or be not reduced, will depend on the amount of the reduction in the acreage, and on the effect of any efforts to improve the pasture and meadows by manuring, draining or other means.

Improvement of Grass Land.—On many dairy farms in the pastoral districts of England, if the acreage broken up be but a small percentage of the total in grass, suitable manuring of the remainder should bring about such an improvement that its stock-carrying capacity is made equal to that of the total area formerly in grass.

The results of the well-known "manuring for milk" experiment carried out at the Midland Agricultural College may be quoted in support of this opinion. In April, 1909, two plots of four acres each of poor pasture, similar in every respect, were fenced off and dressed with 10 cwt. per acre of ground lime. Plot A. received no further manuring, and plot B. received 4 cwt. super-phosphate and 1½ cwt. sulphate of potash per acre. The effect of this dressing was measured during the summers of 1909, 1910, 1911, 1912, by comparing the total weight of milk produced by the cows grazing on both plots, the cows being changed from plot to plot every fortnight.

The yield of milk obtained from each plot over the 4-year period was as follows :—

Year	Yield from plot A (unmanured) lb. Milk	Yield from plot B (manured) lb. Milk
1909	5,531	9,020¾
1910	6,685	10,233¼
1911	5,586½	8,921¼
1912	8,740	13,661
Totals	26,545½	41,836½
Yield per acre per annum	1,659	2,614

Increase per acre per annum due to manuring 955 lb. = 92 gallons.

In 1912 the milk was valued at 6d. per gallon, and the above increase in yield gave a profit after deducting the first cost of the manures of 1*l.* 19*s.* per acre per annum.

Although super-phosphate and sulphate of potash were most suitable for the soil on which this experiment was carried out, it is probable that basic slag and farmyard manure would be more suitable for the average dairy pasture. It seems a reasonable inference from the above that much of the second rate grass land in the pastoral districts of England could be made to produce by suitable manuring at least 50 gallons more milk per acre annually, (say an increase of from 175 gallons to 225 gallons per acre) than it has done in the past, and on this basis 40 acres pasture after manuring should produce fully as much milk as 50 acres did before. The output of milk may thus be maintained and 10 acres or 20 per cent. liberated for arable cultivation.

Cropping of Arable on Farms formerly all grass.— On dairy farms formerly wholly in grass if the area to be broken up be taken from the proportion formerly meadow (thus leaving the pasture acreage as before and avoiding any difficulty in respect of summer keep) and devoted chiefly to root crops, it should be possible easily to provide a supply of autumn and winter food more than equal in milk producing quality to the hay which was formerly produced on the same acreage. This aspect of the breaking up of grass land has been discussed fully in a bulletin issued by the Food Production Department ("The Production of Winter Keep on Grass Dairy Farms").

This bulletin compares the amount and value for milk production of the foods obtained from one acre meadow hay with that obtained from one acre oats, or one acre swedes and turnips, or one acre mangolds, and it is shown that, assuming yields similar to the average for England as a whole, the acreage under arable may be expected to produce considerably more food than the same acreage under grass, and thus also lessen the requirements of purchased concentrated foods. For instance, if ten acres oats be grown in place of ten acres meadow hay, the *additional food* produced will be equivalent to 2,777 lb. of concentrates, or sufficient to replace 6 lb. per cow daily of purchased cake and meal for 40 *cows for* 11½ *days*. If five acres swedes and turnips be grown in place of five acres meadow hay the *additional food* produced will be equivalent to 6,250 lb. of concentrates, or sufficient for 40 *cows for* 26 *days*. If five acres mangolds be grown in place of five acres of hay the *additional food* will be equivalent to 12,500 lb. of concentrates, or sufficient to replace 6 lb. of cake and meal per cow daily for 40 *cows for* 52 *days*.

Cropping of Arable on Mixed Farms.—On dairy farms which formerly consisted of both arable and grass land, an increase in the arable may result in one of the following variations of the acreages devoted to the different crops, the particular variation depending on the nature of the soil, the climate, the supply of labour, &c.

1. *The rotation may be lengthened from* 4 *to* 5 *or* 6 *years by leaving the "seeds" mixture down for two or three years.* Where this practice is followed the total acreage on the farm devoted to pasture and hay, and of course also to cereals and to green crops after the transitional period of a year or two, may remain much the same as before, but an important difference will be that the land which formerly produced 15 to 25 cwt. per acre of meadow hay and a very moderate aftermath, will now produce 35 to 45 cwt. per acre of "seeds" hay, and a much superior aftermath. This system also obviates any risk of a reduction in the head of stock through a lessened production of cattle foods, but it has the serious drawback that it does not add to the national acreage under grain, and in the present emergency even dairy farmers must make every effort to grow grain for human use as well as to maintain their herds and output of milk.

2. *The same rotation may be maintained, but the acreage under each crop increased or new crops introduced.* If this method be followed without introducing new crops there will be an increase of all kinds of produce from the arable land, but where the rotation has been a simple 4, 5, or 6-course, it is difficult to see how the usual head of stock can be carried through the summer unless the pasture be kept approximately the same as in previous years, and the acreage to be converted into arable taken entirely from the meadows. If this plan be followed then no diminution of the stock should be necessary at any season. Thus, if we assume 20 acres converted from meadow to arable and the acreages of cereals, "seeds" and green

crops increased by 10, 5 and 5 acres respectively, the yields of winter food for stock may be compared as follows :—

Produce of Meadow.

1	20 acres yielding 25 cwt. hay per acre	= Total 25 tons.

Produce of Arable.

1	10 acres grain, of which say oats 5 acres yielding 30 cwt straw per acre = 7½ tons straw approx equal to	3¾ tons hay
2	5 acres "seeds" hay yielding (first cut only) 40 cwt per acre	=10 tons hay
3	5 acres roots yielding 15 tons per acre = 75 tons approx equal to	15 tons hay
4	Tail corn from 10 acres, say 1 ton approx equal to	2 tons hay
		Total 30¾ tons

In the above comparison of the relative production of winter food for cattle from meadow land and arable land 2 lb. of straw, 5 lb. of roots, and ½ lb. of tail corn are taken as equivalent to 1 lb. of hay, and on this basis the arable land has an advantage to the extent of nearly six tons. No account has been taken of the aftermath from the meadow or from the "seeds," but any correction on this point would not materially reduce the balance in favour of the arable land. In addition, the grain from ten acres of cereals has been added to the national stock of bread corn

An illustration of how the same rotation may be continued, but new crops introduced on the green crop area so as to maintain or increase the production of cattle food during the transition period and afterwards, is given in Food Production Leaflet No. 7, "The Maintenance of Supplies of Hay and other Fodder Crops," issued by the Board of Agriculture.

3. *The rotation may be lengthened by increasing the number of cereal or green crops, or by the introduction of new crops, or by a combination of these.* If the increase in the arable land leads to the rotation being lengthened by adopting a five-course with three straw crops instead of a four-course with two, then the supply of winter fodder must undoubtedly suffer somewhat, unless some modification is made in the cropping of the area devoted to fallow crops. It is on farms of this type that the grass land may be converted into the most generally useful arable, hence it is desirable to consider more fully how the cropping may be changed so as to allow of the maintenance of the existing dairy herds, particularly during the transition period from the one rotation to the other.

If we assume that on a mixed farm of say 250 to 300 acres the arable is to be increased in 1918 from 112 acres to 140 acres, and the rotation to be lengthened from a four to a five course, the desired results may be obtained by taking oats and beans or peas on the twenty-eight acres newly broken up, and modifying the green crop area to allow of the introduction of a vetch and oat mixture for soiling, for silage or for hay, and of rye to be followed by maize or turnips.

The acreage under the various crops and the order of succession during the transition years are shown in tabular form on page 10.

The approximate acreages of the various crops will be as follows:—

	1917	1918, 1919, 1920, &c.
Wheat	36	48—40
Oats	20	28—36
"Seeds" (for hay)	28	28
Beans and Peas	8	8
Mangolds	12	12
Swedes	4	3
Cabbage	4	3
Rye followed by Maize or Turnips	—	2
Vetches and Oats (for soiling, silage or hay)	—	8
Total arable acreage	112	140

As an alternative to vetches and oats for summer soiling, a few acres of lucerne or lucerne mixture might be sown. Where the soil is suitable and a good plant can be obtained, this crop will produce a greater weight of green forage or hay per acre during the season than can be obtained from any other soiling crop ; further, there is no expense in seed and cultivation after the first year ; the forage or hay obtained is of high nutritive value (reducing the need for concentrated feeding-stuffs) and the fertility of the soil is materially increased.

It may be argued that the changes in cropping advocated above involve considerable risks of failure as the best methods of cultivation, sowing and harvesting some of the crops suggested are not generally known in many of the dairy farming districts.

This is no doubt true, but it is equally true that in time of war risks must be taken, and new ideas and methods brought into operation in Agriculture as in other spheres. It is also true that the amount of risk in farming will be to a large extent in inverse proportion to the amount of knowledge, skill, foresight and determination which each individual farmer applies to his own task. While some of the crops suggested may be little known in some districts, in others they are well known, and under the conditions of national necessity obtaining at present, farmers may be expected to spare no effort to obtain and make the most intelligent use of all suggestions and hints as to how they also may do successfully under their own conditions that which others have done under theirs. Where the

Suggested Scheme of Cropping during the transition period from a Four-Course to a Five-Course Rotation, with an increase in the acreage of arable and the introduction of new crops.

1917		1918		1919		1920		1921	
Wheat	28	Mangolds Swedes Cabbage Rye (followed by Maize or Turnips) Vetches and Oats (part cut green* if necessary; remainder made into silage or hay)	12 3 3 2 8 (28)	Wheat Oats	12 16 (28)	"Seeds"	28	Wheat	28
Mangolds Swedes Cabbage Beans or Peas	12 4 4 8 (28)	Wheat Oats Wheat	12 8 8 (28)	"Seeds"	28	Wheat	28	Oats Beans or Peas	20 8 (28)
Wheat Oats	8 20 (28)	"Seeds"	28	Wheat	28	Oats Beans or Peas	20 8 (28)	Swedes Cabbage Rye (then Maize or Turnips) Vetches and Oats Mangolds.	3 3 2 8 12 (28)
"Seeds"	28	Wheat	28	Mangolds. Swedes Cabbage Rye (then Maize or Turnips) Vetches and Oats (for green food, silage or hay)	12 3 3 2 8 (28)	Wheat Oats	12 16 (28)	"Seeds"	28
Meadow Hay taken, then ploughed	28	Beans or Peas Oats	8 20 (28)	Wheat Oats Beans or Peas	8 12 8 (28)	Swedes Cabbage Rye (then Maize or Turnips) Mangolds. Vetches and Oats	3 3 2 12 8 (28)	Oats Wheat	16 12 (28)

risk of failure with summer soiling crops is great it is probably desirable that more attention should be given to the improvement of pasture which will not be broken up, in order that the supply of food during summer may be maintained.

The preceding paragraphs on the provision of food for dairy stock from arable land instead of from grass land have had special reference to the changes in acreage most probable in 1918 and 1919, but it must be realised that the National Food Production policy for the following years is almost certain to require the ploughing up of an additional acreage of grass land. It is, therefore, of extreme importance that dairy farmers should lose no time in adapting their systems of cropping and feeding to the conditions of the future. The successful adaptation of methods to these new conditions is essential to victory in this war, and blind adherence to old customs and methods can only lead to starvation and defeat.

EFFECT ON THE COST OF PRODUCTION OF MILK.

The second point which must of necessity follow any consideration of an increase in the arable land and the adoption of new methods of cropping and of feeding dairy stock is whether these changes can be carried out at a reasonable cost.

No tabulation of statistics is necessary to make it clear that the cropping of arable land is more costly than the management of pasture and meadow, but the amount by which an increase in the arable will increase the cost of cultivation, &c., must vary from farm to farm, according to the acreage broken up and the local conditions of labour, soil, climate, and equipment. On small grass farms of the type and location already referred to, the cost may be relatively high, and on other farms which were recently or are still partly arable, the cost may be relatively low. On the whole, it is difficult to avoid the conclusion that the cost of producing the necessary amounts of home-grown foods will be considerably greater than under the grazing system previously followed. Other conditions being equal, the cost of milk production must therefore be somewhat increased, and the margin for profit correspondingly lowered.

A closer examination of the situation, however, indicates that this increase in the cost of production will be most noticeable in the summer months ; during the winter the cost may even be somewhat reduced. The increase in summer will be due to the use of soiling crops to supplement the pasture, but on this point it is desirable to refer again to the relative cheapness and to the other advantages of lucerne or lucerne mixtures as compared with a vetch and oat mixture or other annual crops. The neglect of lucerne on the dairy farms of England is one of the weak spots of contemporary farming, and if its value were more fully realised much more systematic and determined attempts would be made to overcome the difficulties of getting a good and lasting plant. The increase in the acreage of arable land, the necessity for obtaining the maximum supply of cattle food for summer and winter, for increasing the fertility of the soil and for reducing the use of concentrated feeding-stuffs all point to a greater utilisation of lucerne in the future than in the past, and in time it may make for itself in Britain the reputation which it already has in North America and other countries—that of being a well-nigh indispensable crop on a profitable dairy farm.

The probability of a reduction in the cost of winter feeding to a lower level than would otherwise be possible follows from the greater variety and nutritive value of the foods made available in place of meadow hay, and it should become possible to reduce the consumption of purchased cakes and meals; at the prices which will most probably rule for some time to come, any such reduction, though of only 2 lb. of cake per day, will make a marked difference in the cost of feeding.

Although from the above it appears certain that the cost of milk production on farms depending to some extent on arable land crops may be higher than on those depending on grass land for the maintenance of the existing dairy herds, it does not necessarily follow that the farm as a whole will be less profitable. In addition to the crops consumed on the farm, there is the return from the grain sold to be taken into account. In spite of the increased expenditure on horses, equipment, labour, seeds and manures, the conditions prevailing at present and likely to prevail for some years to come, both at home and abroad, indicate that the price of grain is almost sure to remain at a figure which will make its production profitable except in specially unfavourable circumstances. Many dairy farmers with large mixed farms will be able to take full advantage of these conditions, and any decrease in the margin for profit on milk production should be more than made up by the increase in the margin on cereals. On the other hand, on farms with smaller proportions of arable land, the amount of grain available for sale will be comparatively small, and it may happen that the increased cost of producing foods for the dairy herd will not be balanced by a corresponding increase in the return from the grain.

On these points it is apparent that no answer based on the actual financial returns from farms where the system of cropping and feeding outlined above has been adopted in place of that formerly practised can be given at the present time, but it is scarcely open to doubt that there will be important changes in the relative profit and loss from the different departments of a farm. These changes will have a direct bearing on the kinds and quantities of food produced on farms, and it is therefore desirable to consider to what extent dairy farming may be affected.

PROBABILITY OF OTHER SYSTEMS OF FARMING BECOMING MORE REMUNERATIVE.

The first indirect effect of the new agricultural policy on dairy farming is that other systems may become equally or more remunerative with less worry and work, and farmers will therefore be tempted to give up milk production.

The changes implied under this head are much more subtle and far-reaching than those considered under the decrease in the acreage of pasture; it is most probable that they will develop slowly and without the publicity which has been and will be associated with the ploughing up of grass land.

The supreme national necessity supplying the driving-power to the Food Production Departments' "plough policy" is not yet adequately realised in many districts, hence the requests and instructions to break up grass land are argued about and complained of to an almost unnecessary extent amongst farmers, and receive considerable publicity in the agricultural and provincial press, whereas a change from dairying to other systems of farming due to the difference in the relative profit accruing from each will be to the farmers' advantage and therefore will not be brought so readily to public notice. At the same time any change due to this cause will be much more dangerous ultimately to the dairy industry of this country.

It may be of interest here to attempt to state the reasons which may actuate a farmer in taking up dairy farming—whether milk production for sale, cheese-making, or butter-making.

1. Because it is considered the most profitable system of farming.

2. Because it is the system of farming with which the farmer is most familiar.

3. Because it is the system for which the farm is best suited.

4. Because the farmer is specially interested in the breeding and improving of dairy stock.

The foregoing reasons are not individually distinct, and from some points of view the second, third and fourth reasons may be regarded as different aspects of the first, since the ultimate reason why a farmer follows any particular system may be assumed to be that he believes that system to be the most profitable one for him to follow on his particular farm.

When one considers the great variation in farming systems and methods, however, one might be led to think that the question of the relative amount of the profit accruing from any particular system does not influence the farmer to the same extent as it would influence the manager or directors of other forms of business, and that many farmers are working on lines which are demonstrably less profitable than others which might be adopted. This may be true to some degree, but it should be remembered that many farmers in districts devoted to a particular type of farming for a long period of years are almost or entirely ignorant of the methods in use in other districts. Thus a farmer who has been accustomed from his youth up to the management of grass land could not be expected to be as successful in the management of a tillage farm, or even to be anxious to undertake this responsibility. Also, for reasons due to the character of the soil, or the position as regards rail or road communications to markets, a farm may be profitable although managed on a system quite different from that followed on other farms in the same district. For instance, in the "home counties" the regular demand for hay has led to some farms being very largely cropped as meadows, though similar farms in other districts are chiefly devoted to dairying; also around many cities the price obtainable for and the easy delivery of milk has led to herds of cows being maintained on farms of a type which in other districts would fatten large numbers of bullocks. Lastly, the tastes of the individual exercise an incalculable but nevertheless powerful influence, particularly in deciding between greater and lesser profits. For instance, an enthusiast in breeding will often be content to continue his breeding herd so long as he makes a fair percentage on his capital, though by ceasing to breed stock he might appear to have the chance of doubling that percentage. The enthusiastic improver of live stock by breeding usually recognises that he is engaged in a work which cannot be brought to a conclusion in his own life-time, hence he is accustomed to take long views and not to allow his aims to be unduly influenced by temporary changes in the prices of crops and in the apparent relative profit in other branches of farming.

In spite of the incalculable effect of the personal factor, however, it is undoubtedly true that the general tendency amongst farmers is to adopt to a greater or lesser extent that system which over a period of years is likely to be the most profitable. During the last two or three decades there have been practical illustrations in many counties that milk production was more profitable, or at least less risky, than other systems, and in some areas farmers had practically no other choice than to take up this system if they wished to remain solvent. This change necessitated much more strenuous labour and constant attention to details, but in spite of the early and late hours every day of the week and under all conditions of weather the regular and frequent financial returns constituted a sufficient inducement and reward.

The new agricultural policy has created a new point of view, and has given to other branches of farming, and particularly to grain growing, a security which they did not formerly possess and it is a legitimate expectation that as an assured return may be obtained without the drudgery and long hours at all seasons associated with milk production, many farmers will dispose of or will materially reduce their dairy herds. The necessity which brought this system of farming into districts not traditionally devoted to dairying has ceased to operate.

There is no doubt also that the greater the surety that this new policy is a fixed national one for the future and independent of political parties, the greater the risk that milk production will be seriously lessened in many districts. That this tendency has not been more marked during the past two years has been due to the farmer's natural inclination to take long views, to his caution and desire to avoid risks, and to his fear that the policy of the maximum production of grain at home is not a fixed one. He has no certainty that the immense urban population of Britain will not insist on a reversal or a great modification of this policy in the course of the next few years.

In considering the possibility of this change in farm practice one must not be misled by taking the comparatively slow rate of increase in the practice of milk production in the last twenty to thirty years as a basis of estimation. The spread of information on improved and alternative methods of farming was increasing fairly rapidly before the war by means of the agricultural press, the Agricultural Colleges, and County Agricultural Education Authorities and the great annual shows, but the effect of twenty years work of these agencies will be more than equalled by three years work of the County War Executive Committees and the Food Production Department under the stress of war. To this must be added the stimulus given to every aspect of agricultural account keeping by the action of the Government in fixing minimum prices for wheat, oats, potatoes, and milk, and in fixing through the Food Controller maximum prices from the producer upwards for almost all kinds of farm produce. The full educational effect of the changes brought about by the war can only be vaguely estimated at present, but it is quite clear that the relative profit on different branches of farming will be determined much more quickly and accurately in the future than in the past, and that the rate of change away from the losing or less profitable practices to those which are more profitable will be greatly accelerated.

Although it has been shown in the preceding pages that cereal growing on an increased scale is not necessarily incompatible with the production of enough winter and summer food for the maintenance of dairy herds on the pre-war level, the position is that a decrease in the output of milk may follow by the transference to cereal growing of that reliance as to the chief source of income and profit which was formerly placed on milk production. The position may be otherwise stated thus—that in the past on many farms where a dairy herd was kept, the chief source of income was not the crops which were sold off the farm as such, but those from both arable and grass land which were fed to the cows and sold after conversion into milk; in the future on farms where cereals can be grown to an appreciable extent, the chief source of income will be grain, and it will not be so necessary to maintain cows as a means of the profitable utilisation of other crops. The only necessity will be that those other crops (roots, hay and straw) be consumed in such a manner that the fertility of the farm be maintained, and this end may be more easily and completely achieved with fatting cattle, or with sheep, or with both, than with a herd of milking cows. The real question for the future, therefore, arising out of this consideration of the indirect effect of the new policy on dairy farming on this class of farms is—will the profit on the production and sale of milk and its products be sufficient to make a farmer prefer to make use of his roots, hay and straw by means of cows rather than by means of cattle and sheep?

But though the problem may be stated in this simple fashion, the answer cannot be as easily given. It is dependent on the interaction of many factors, and must vary from farm to farm and from district to district. The supplies of concentrated feeding stuffs, the price of fat cattle and sheep, the supply of labour, the rate of wages, and other circumstances affecting the production of grain, milk and meat, must exercise some influence, but the degree of effect and the final result cannot be anticipated at present.

On another class of farm, namely those on the outskirts of large towns, where milk production was and is carried on in combination with market gardening, the high prices now obtainable for potatoes and all kinds of vegetables make it appear much more profitable to develop this side of the farm than to maintain the present dairy herd. In other words, crops can be grown which supply more food and leave more profit when sold for direct human consumption than would be obtained by growing the same or other crops and feeding them to the cows. The necessity for a supply of animal manure for the crops in question may, however, retard to some extent the dispersal of cows from farms of this class. Town manure continues to decrease in quantity and increase in price.

PROBABILITY OF DECREASE IN MILK PRODUCTION IN THE EAST AND INCREASE IN THE WEST.

The second indirect effect of the new policy is that by a combination of the increased difficulty in maintaining herds of cows with the equal or greater remuneration obtainable from other methods of farming, milk production may be greatly reduced in those areas naturally adapted for profitable grain production, and increased in others where the natural conditions enable milk to be produced most cheaply.

If the Corn Production Bill were the only instance of State action affecting Agriculture at the present time, this probable effect would only become evident in the course of a few years, but it is undoubtedly the case that the maximum prices for milk fixed by the Ministry of Food are exerting an influence which will bring about the same result in a comparatively short space of time. This aspect of the situation will be referred to briefly later.

An examination of the sources of the milk supply of most of the large cities of England in pre-war days would have brought to light the fact that, with the exception of London, the requirements of any city were almost entirely met by the farmers in the surrounding counties. Even in the case of cities located in counties which were preponderantly arable, the returns from milk production were sufficiently satisfactory to make it worth the while of farmers in the vicinity to take up this system of farming. In respect of London the demand increased to such an extent in recent years that milk was drawn from half the counties in England, not only from the traditionally dairying areas of the West and Midlands, but also from the Eastern counties and from other districts where the soil was easily worked and eminently suitable for arable cultivation. In the latter areas this demand often led farmers to lay down arable to pasture so that they might be able to maintain their cows as cheaply as possible during the summer, even after the prices of grain and other farm produce again had begun to show a slight but regular upward tendency.

In order to carry out the schemes of the Food Production Department, it is precisely grass fields of this description which have been selected first for reconversion into arable, and in spite of the fact that on these farms the growth of soiling crops such as rye, trifolium, vetches and maize has been most largely practised and is best understood, the breaking up of the pasture, associated with the larger returns now obtainable from cereals, will undoubtedly tend to the reduction, if not the dispersal, of many dairy herds.

One is therefore forced to the conclusion that the proportion of London's milk supply drawn from the Eastern counties of England, and from other districts where tillage is comparatively easy, cannot fail to decrease for a period of years, while the cities and towns located in these districts are likely to have a much restricted local supply and suffer from periodical shortages.

On the other hand, there is already evidence that in some districts in the Western counties the numbers of dairy stock have increased during the last three years and the high prices obtainable for milk and cheese, together with a comparatively low cost of production are factors directly tending to encourage this change.

On many farms in these counties there was great room for improvement in the management of the grass land, and in so far as the campaign for an increase in the arable land has led to the manuring and better treatment of the acreage remaining in pasture, the stock-carrying capacity of the farms has not been in any way reduced; also during the past two summers the weather has been in favour of milk production, and it has been possible to go through both summer and winter with the use of the minimum quantity of concentrated feeding stuffs.

Apart, however, from the effects of the Corn Production Act, which can only have come into operation during 1917, the increase in the price of milk and milk products and the control of milk prices by the Ministry of Food have materially assisted dairy farming in the Western counties. The price of milk rose much more slowly after the outbreak of war than the price of other commodities, but the factors contributing to a higher cost, namely, the use of large amounts of purchased feeding stuffs and the rise in wages, came into operation much more quickly in the Eastern counties and in the densely populated industrial districts than in the pastoral counties towards the South-West, with the result that in the former, dairy farmers had great difficulty in making ends meet, while in the latter they had a reasonable margin. The first Milk Prices Order, giving an increase to the producer of 6½*d.* per gallon above pre-war price, allowed local variations arising out of local conditions to continue, but while this sum was ample in the districts of cheap production it was in many other instances insufficient. The present Order[1], however, although fixing a uniform maximum to all producers at their local stations, takes no account of districts of high and low costs of production, and as this cost is much less in the South-Western and Western counties, with their ample supplies of grass and comparatively mild winters, than in the Eastern counties where the pasture is inferior, the winters more severe and the practice of indoor feeding almost universal, the effect of the flat rate must be to encourage dairy farming in the West and discourage it in the East.

Thus, whatever tendency may have arisen from the breaking-up of pasture and associated factors towards a redistribution of the numbers of cows, the method of the Ministry of Food in the fixing of milk prices has greatly accelerated this movement, and it is as well to realise that this change must accentuate the difficulties already associated with the distribution of milk. It is necessary at present to forward milk from Dorset and neighbouring counties to towns in East Kent and any serious increase in this practice would raise, amongst others, the very large question of the most economical use of the railways in relation to the transit of milk.

FUTURE SUPPLY OF LABOUR.

In addition to the probable changes in dairy farming considered in the preceding pages as likely to follow from the new agricultural policy there is at least one other to which attention must be drawn. This is the supply of labour for dairy farms. It is hardly possible to discuss this subject at the present time in more than vague generalities, as the problems associated with it differ from those already considered in that they will be more profoundly affected by the termination of the war. The need for the utmost production of food at home will be even greater after peace has been declared than at the present time, and every month added to the duration of the war increases but does not alter greatly the nature of the difficulties of supply which will then have to be faced; the post-war labour problems, however, will be different in many respects from those which have to be dealt with at present, as it cannot be assumed that soldier labour will continue to be provided for any length of time after the end of the war.

The increased production of home-grown food is bound up indissolubly with the provision of a sufficient supply of labour for the farms, and the minimum wage guaranteed to agricultural labourers by the Corn Production Act is only one step in the direction of providing inducements to men to return to or to remain on the land. The questions of sufficient and satisfactory housing accommodation, of the hours of labour, of whole and half-holidays, &c., will all arise after the war, and whether the required labour will be forthcoming or not will depend on the answers that can be given.

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[1] The Milk Order (No. 939) fixing maximum prices from October 1st, 1917, to March 31st, 1918.

From the dairy farmer's point of view it should be realised that he has not only to pay the minimum wage without any guaranteed minimum price for milk except such as may be promised through the Food Controller, but that the work in connection with milk production is the most continuously exacting of all farm labour; it is the most difficult to fit in with any system of a fixed number of hours per week, or of half-holidays. If, in the future, therefore, labourers have a choice, as they undoubtedly will have, firstly, between work in the colonies and work at home; secondly, between city and country work; and thirdly, between work without cows and work with cows, there is little doubt that the last mentioned will only be undertaken with the certainty of a corresponding payment. Further, the educational effect of war and war conditions on the farmer already referred to, will extend to the labourer, and it will hardly be possible to maintain in the future the extreme differences which have existed in the past between the rates of wages in one county and in another.

It is unnecessary to dwell further on this matter now, but it should be evident that if dairy farmers are to retain the labour necessary to maintain their output of milk after the war, they must be able and willing to study and adopt all practicable labour-saving methods. This may involve rearrangement or reconstruction of farm buildings, a much greater introduction of mechanical milkers and other mechanical devices for reducing labour in cleaning cowsheds, in the preparation of foods and of feeding, and it should certainly lead to a careful consideration as to how far co-operation in the collection, treatment and the utilisation of milk may bring about a much-to-be-desired modification of the working hours on the dairy farm.

DAIRY FARMING IN RELATION TO THE NATION'S FOOD SUPPLY.

Reference has been made on a previous page to the fact that the policy of the production of the maximum amount of food at home is as yet in its earliest stages of development, and up to the present attention has been almost entirely directed to the encouragement of cereal and potato growing. The greater quantity of human food obtained per acre from these crops than from others, such as hay and roots (which are only of indirect value, producing human food only through the medium of live stock), is an all-sufficient reason for this concentration of effort. At the same time it is most desirable that the value of other systems of farming as contributors to the food supply of the nation should not be overlooked.

The point has already been made that the selection of alternatives is not between grain growing and milk production, between arable and pasture, but *between the cow and other kinds of farm live stock as agents for the conversion into human food of those field crops which are not suitable for direct human consumption.* The relative economy of the different classes of farm animals for this purpose received but little study in this country prior to 1915 and the supreme position of the cow in such a comparison was not generally realised.

In a most careful and exhaustive Report drawn up by a Committee of the Royal Society, and entitled "The Food Supply of the United Kingdom," there appears the following statement :—

> "Considerable economy in fodder can be effected by varying the kind of animal to which it is fed. All animals are by no means equally good 'converters,' as is shown by the following figures :—
>
> | Lb. Starch Equivalent in Fodder | required to produce | 1,000 Calories in the form of |
> |---|---|---|
> | 2·9 | | Milk from good cow (800 galls.). |
> | 3·0 | | Pig Meat. |
> | 4·7 | | Veal. |
> | 4·7 | | Milk from bad cow (300 galls.). |
> | 5·3 | | Mutton. |
> | 7·0 | | Eggs. |
> | 7·0 | | "Baby" beef. |
> | 9·0 | | "Steer" beef. |
>
> "These figures justify the agricultural policy of most Continental countries which rely on dairy products, pig meat and veal, for a very large proportion of their supply of animal food. A given supply of fodder is capable of producing a far greater amount of protein and calories in these forms than if it is used to a very large extent as in Great Britain for the production of mutton and beef."

Much might be written in qualification of these figures, such as the dependence of the pig on foods which are suitable for direct human consumption, the importance of the sheep as a source of wool and as a factor in the successful cropping of light arable land, also the greater labour required by cows—it is highly desirable that the returns per unit of labour and per unit of capital should be worked out in addition to the returns per unit of starch equivalent consumed—but in spite of all possible qualifications, it is indisputable that the cow surpasses all farm animals in her power to convert the crops of the field into human food. Further, the returns from the pig, steer and sheep are obtained only after these animals are killed, whereas the cow continues alive and productive—in fact, the ultimate source of veal and beef as well as of milk.

In addition to the importance of the cow as shown above, we have the unique value of milk itself as a food and the undeniable fact that not enough milk was and is consumed by infants and children. The increase in milk production in England since 1870 has been referred to, and the following comparisons of increases in cows, in population and in value of imports of dairy products are probably surprising and most certainly instructive :—

Comparative Increases in Population, Number of Cows, and Value of Imports of Dairy Produce, 1871 *to* 1914.

Year	Population of Great Britain		Cows and Heifers in Great Britain		Value of Dairy Produce imported into United Kingdom[2]	
		1871=100		1871=100	£	1871=100
1871	26,072,284	100	2,091,433	100	10,280,536	100
1881	29,710,012	113	2,270,268	109	16,111,266	156
1891	33,028,172	126	2,657,054	127	20,862,960	202
1901	36,999,946	142	2,602,294	124	29,894,760	290
1911	40,831,396	156	2,825,049	135	36,272,743	352
1914	[1]41,700,000	160	2,937,923	140	38,203,314	370

[1] Estimated. [2] Almost entirely imported into Great Britain.

The above Table shows that the rate of increase in population during the last half century has considerably exceeded the rate of increase in the numbers of cows and heifers, and that the value of the dairy produce imported has increased in a most extraordinary manner in the same period. Nothing could show more clearly the need for an increase in the dairy stock in this country after the war if the dependence of our population on imported dairy produce is to be reduced to any appreciable extent.

A sentence has been quoted from the Committee of the Royal Society's Report on the attention directed to the development of dairying and the associated industry of pig-farming in Continental countries. It may be of interest to compare the relative density of the population and the numbers of the different kinds of live stock in those European countries for which the figures are available :—

Density of Population and Numbers of Live Stock per 100 *Acres of Cultivated Land.*

(Calculated from Agricultural Statistics 1911 and 1912)

Country	Population		Live stock per 100 acres cultivated land				
	Per sq. mile	Per 100 acres cultivated land	Total cattle	Cows	Other cattle	Pigs	Sheep
Belgium	658	167 7	40 9	20 9	20 0	30 1	?[1]
Holland	407	112 7	38 1	20 1	18 0	23 7	16 7
United Kingdom	374	97 2	25 4	9 4	16 0	8 5	61 9
Germany	311	82 6	24 5	12 7	11 8	26 6	7 0
Switzerland	236	69 0	26 2	14 5	11 7	10·3	2 9
Austria	222	63 9	20 1	10 8	9 3	14 1	5 3
France	193	44 2	16 2	8 6	7 6	7 6	18 0
Denmark	180	40 5	32 5	18 5	14 0	21 2	10 5
Sweden	32	45 0	21 9	15 0	6 9	7 7	7 7

[1] Not enumerated since 1895

The above countries are tabulated in the order of the density of population, and it will be noted that while the United Kingdom is third in this respect no less than seven out of the nine have a larger proportionate number of cows and six have a larger proportionate number of pigs. Surely it would only be to the great and lasting benefit of this country if the numbers of cows were increased to the proportion found in Switzerland, Sweden or Denmark, leaving as an object lesson in what can be done in the maintenance of stock in a densely populated country the achievements of Holland and Belgium.

More could be added if more were necessary to show the value and importance of the dairy industry in relation to the nation's food supply, but enough has been said to make it abundantly clear that any diminution in milk production would be a step away from instead of towards the ideal of the production of a "safe" amount of food at home.

The maintenance of the output of milk during the war and the possibility of the much-to-be-desired increase afterwards depend on the action taken by the Government Departments concerned on two most important points. The first of these is the *price* which the producer receives. Unless the production and sale of milk and milk products is allowed to become reasonably profitable the supply will diminish. The second is the provision of *means of education* whereby the dairy farmer may be assisted and enabled to adapt his methods to the new conditions as quickly as possible and with the least loss to himself. If the educational work in respect of milk recording, economy in feeding, and suitable and improved methods of cropping be resumed and extended, with practical demonstrations where possible, throughout every dairy district in England, satisfactory conditions as to price will be more generally and quickly attained, also the quality of dairy stock and dairy produce, and the standard of dairy farming as a whole, will be raised to a higher level to the benefit of the individual farmer and of the nation at large.

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THE WASTAGE OF MILK.

FOR some time past inquiries have been carried out concerning the losses and sources of loss which occur in the Milk and Dairy Industries. These inquiries were undertaken partly in order to demonstrate the need or otherwise of investigations, partly in order to find out in which directions such investigations, if necessary, might be most profitably undertaken. Many of the inquiries are still incomplete; but the following figures, dealing with milk sent by rail for human consumption, are sufficiently significant to be worthy of consideration.

The figures shown in Table I represent the average annual losses in the milk industries in two widely separated districts.

The first district was in receipt of an annual supply of rail milk of about 90,000,000 gallons. When inquiries were made among the distributors of the milk in the district the following sources of loss were found to exist:

(1) Milk which arrived sour and unfit for distribution, 1 per cent.
(2) Loss by splashing, about 3 pints per churn.
(3) Milk which, though not sour, yet required pasteurization before delivery to consumers, 10 per cent.
(4) Irregularity of supply and demand, necessitating the purchase of accommodation milk and the sale of surplus milk. The average loss from this cause amounted to 1*d*. per gallon.

The annual milk supply of the second district amounted to 75,000,000 gallons. In this case no information was given concerning losses (2), (3) and (4), but the loss from sour milk was stated to be 1 to 2 per cent of the whole. This second milk supply was in a dairying district, and it is possible that some of the losses found in districts which produce milk for human consumption only, *e.g.*, irregularity of supply, may be avoided, but it is probable that the loss by splashing, which seems to be general, was suffered. If it be assumed that each churn was full when it was sent out, this loss would amount to 1,654,000 gallons in the course of a year.

If the value of milk be taken at 1s. a gallon, then the following losses are found to occur in these two supplies :—

TABLE I.

		Gallons of milk annually	Value at 1*s*. a gallon
District 1 .		90,000,000	£4,500,000
	Losses—		
	(1) 1 per cent. sour	900,000	45,000
	(2) 3 pints per churn lost by splashing	1,965,441	98,272
	(3) 10 per cent. pasteurized at ½*d* a gallon	8,713,455	18,153
	(4) Irregularity of supply and demand necessitating purchase of accommodation milk and sale of surplus at a loss, 1*d*. a gallon . .		375,000
	Total losses		£536,425

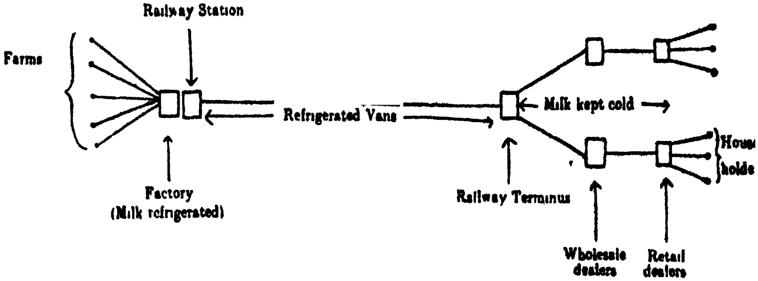
These losses represent a loss of about one-ninth of the monetary value of this supply.

District 2. .		75,000,000	£3,750,000
	Losses—		
	1–2 per cent. sour at 1 per cent.	750,000	37,500

If these figures be considered it is clear that the sources of loss may be divided into two main groups : (1) those which involve not only financial loss but also the loss of valuable food stuff, and (2) those which at first sight would appear to be trade losses ; none the less they are of importance to the nation, since their incidence must be considered by the dealer in fixing his price to the consumer, and they must therefore tend to increase the cost of milk. The loss due to souring in district 1 amounted to 900,000 gallons, and in district 2 to not less than 750,000 gallons. If it be assumed that there was no loss by splashing in district 2 there remains an annual loss of 1,965,441 gallons of milk in district 1 from this cause.

The losses due to sour milk and waste by splashing when taken together show that of 165,000,000 gallons of milk, not less than 3,615,441 gallons were wasted, representing a loss of about 2 per cent. of the whole supply, and a very serious loss of valuable food stuff.

The remaining sources of loss comprised that portion of the milk which required to be pasteurized before it could be sent out, and serious trade loss due to irregularities of supply. The former does not represent a very grave monetary loss, but it is a question whether the nutritive value of such milk is equal to that of raw milk. The latter is, in the first instance, a trade loss, but since it amounts to 1*d.* a gallon, it represents an additional cost to the consumer of at least ¼*d.* a quart. The sum of all these losses represents a very considerable wastage of foodstuff and also a serious financial loss; the question therefore presents itself whether such losses are really necessary. They appear to depend upon several factors, among which may be mentioned unsatisfactory methods of milk production at the farm, prolonged carriage under unsatisfactory conditions, the attempt to preserve the milk after it has reached its destination instead of at a much earlier stage, the lack of co-operation which has hithero existed between the dairy farmers, the railways and milk distributors, and the irregularity of the public demand for milk. The last of these difficulties cannot be remedied at present; the first must take time, as the production of clean milk, though not very difficult, does require a certain skill which is not at present found among many of the milk producers. Partial remedies for several of these difficulties have been suggested by Williams and Cornish in a pamphlet entitled "The Milk Supply—A Suggestion," in which they advocated the erection of depôts within reach of groups of farms, at which the milk could be thoroughly chilled. In this way it is believed that the milk could be preserved for longer periods of time than is at present possible. The following diagram taken from the pamphlet clearly illustrates this point:—



The soundness of their belief is supported by the work of Kathleen Freear (see Appendices I. and II.), who has very kindly permitted me to make use of some of the observations which she has made in the course of investigations which are not yet completed. Kathleen Freear has studied the periods of time during which average milk remained sweet when taken three hours after milking and preserved at different temperatures (Appendix I.). The milking was not carried out by members of the Staff of the Research Institute in Dairying, but the milk was that regularly produced on a farm for commercial purposes. The cows were milked at about 6 a.m. In the summer they were out in the fields, but were milked (by hand) in the byres. In the winter they slept in the byres in which they were milked. No special precautions were taken to secure cleanliness and the milk was not cooled. It travelled by road from two and a half to three miles, and then quart samples were taken from the churns about three hours after the milking. One of these was put in an ice chest, a second was kept in a cool cellar, and the third at room temperature. The figures in Appendix I. demonstrate that such milk when kept either at room temperatures or at those of the cellar could not be relied upon to remain sweet for twenty-four hours, but when properly cooled, could be kept sweet for a period of not less than four days. The work was carried out at some disadvantage, since it was necessary to place the milk in bulk in the cool chamber where it became gradually chilled, whereas in practice by chilling it in a thin stream it would be possible to cool it much more rapidly.

It was further pointed out by Williams and Cornish that such depôts, being in touch with the needs of the towns, could regulate the supply to their real requirements and convert excess milk either into dried milk or into dairy products, thus preventing that irregularity of supply which has hitherto amounted to a loss of 1*d.* a gallon to the dealer. Appendix IV. shows well the great fluctuations to which the dealer has been subject in order that he may secure sufficient milk to carry on his business. The scheme which has been suggested by Williams and Cornish appears to be based upon sound principles. It has been discussed by many leading members of the milk industry and does not offer insuperable difficulties. There is little doubt that it would lead to diminished financial loss, and the saving of much valuable foodstuff although it would not give a pure milk supply, and it is towards this ideal that all those interested in the milk industry must strive.

The figures shown in Appendix II. demonstrate that the keeping properties of milk depend to a very great extent upon the methods of milking and upon the subsequent care of the milk. The milk which was the subject of this investigation was being produced for commercial purposes. The cows were milked in a milking shed; their udders and flanks were washed. The milkers had clean hands and wore clean overalls. The milking was done by hand into steam-sterilized American buckets, then the milk from each cow was sieved, cooled at once to the temperature of the water of a deep well, and bottled in steam-sterilized quart bottles. It was then sent by rail in a box to the laboratory. No precautions were taken to keep it cool during the journey. It was taken and sent off by rail early in the afternoon of one day and did not reach the laboratory until about one o'clock in the afternoon of the following day. On an average it was already about twenty-four hours old at the time of arrival at the laboratory. Although the milk was not cooled to a very low temperature and in spite of the adverse conditions it suffered during the journey, it is seen that even at the temperatures of the laboratory or the cellar it remained sweet for not less than two days. When, however, it was kept in the ice chest it remained sweet for a period which was never less than eight days. How long such milk would have lasted had the initial cooling been greater and had it been kept refrigerated in transit is not known. Even as it is the figures bring out clearly the importance of cleanliness and immediate cooling upon the keeping properties of milk.

It is the production of milk of this type that the members of the milk industry must have as their aim, since its attainment would not only diminish waste but would conter many benefits upon the members of the industry and upon the public. Among these may be mentioned the facts that it would be much easier to control supplies of milk, since the need for immediate consumption would not be urgent; moreover, its improved keeping properties should lead to more rational hours of labour than those which exist at present in the milk industry, since there should no longer be any necessity to catch an early morning train. We have often wondered how far excessively long hours of work have been responsible for bad milk production. Further there is the fact that the demand for clean milk is increasing, and that it is the duty of the milk and dairy industries to meet that demand.

The production of such milk depends upon two main factors, a sufficient financial incitement and an intelligent conception of the work to be done. The former depends upon the public. If the public will not realise that between clean milk and dirty milk a great gulf is fixed, then it is improbable that much progress will be made. There is, however, every evidence that the public is realising more and more the value of clean milk, and will be prepared to pay an increased price for it. The question, therefore, which remains, is whether the Milk and Dairy Industries will allow the public to attempt to force them to produce clean milk, or whether they will themselves try to produce the best that can be obtained. If they adopt the former course they will find that regulations will be passed governing every stage of milk production and distribution, and endless inspectors will be appointed to see that these regulations are carried out. It is highly improbable that such regulations will really attain their aim. How long have the Dairies, Cowsheds, and Milkshops Orders been in existence, and how many insanitary cowsheds still remain in the country? The figures in Appendix III. are sufficient proof of this. These figures are the results of experiments made at the Lister Institute of twenty-seven samples of milk which was being supplied to Welfare Centres. They demonstrate quite clearly that the milk in the majority of the samples was not clean, and that some of it contained the germs of disease. They are sufficient to demonstrate that in spite of the number of years during which the Dairies, Cowsheds, and Milkshops Orders have been in force, they have not resulted in the production of clean milk.

Far better results might be expected from the recognition by the dairy world of its own importance and responsibilities. The Milk and Dairy Industries are applied sciences, supplying not less than one-twelfth of the whole food stuff of the nation, of a monetary value at 1*s*. a gallon of not less than 50,000,000*l*. per annum. The success or failure of these industries depends upon biological and chemical processes, the understanding of which involves problems at least as complex as those found in any other applied sciences. Let the industries take their stand upon these facts, and insist upon the importance of their own work by making the following demands:—

(1) That no person shall be allowed to undertake milk or dairy work who does not possess a diploma or certificate of efficiency from an authorized body.

(2) That any person holding such diploma or certificate of efficiency who shall be guilty of unbecoming conduct in his work shall be liable to forfeit such diploma or certificate.

(3) That a central authority shall be set up to control the standards of examinations necessary for qualification, and to consider such cases of misconduct as may occur.

Such a scheme could be made to take effect at any time that was thought proper, and all those already engaged in these industries should then be permitted to register.

The adoption of this proposal offers many advantages. It recognises the importance of the work and the dignity of those who are concerned in it. It secures the elimination of the unqualified, and a higher educational standard for those who remain. At the present time Mackintosh has calculated that in any one year not more than one pupil from every forty-five farms enters a dairy school. It leaves the granting and withdrawal of diplomas in the hands of those most concerned. The competition of its own members would to a great extent diminish the need for constant inspection.

The success which has attended such schemes in other applied sciences is sufficient justification for the belief that the milk and dairy industries can be lifted to a different plane. There is no system of inspection to control the work of the medical profession, and yet we trust our lives and the whole health of the nation to these men, who by the standard which is set them by their fellows are the most active in endeavouring to effect improvements in their work, although by constantly reducing the amount of disease in the country this would appear at first sight to be detrimental to the pecuniary interests of the profession. It may be thought that the progress which is constantly taking place in the medical profession is the sum of the efforts of individuals fighting for a better place. There is truth in this, but not the whole truth. The spirit of competition is keen, and its existence is to be commended, but those who spend their lives among medical men know well that there is at the back of their work another and much more inspiring ideal. It is that throughout their lives they have been trained to hate disease and to use all the means within their power to prevent it The same atmosphere exists in the dental profession, and is rapidly being created among the midwives. The passing of the Midwives Bill in 1902 has gradually eliminated the ignorant, and has substituted a body of women who are inspired with the sense of the importance of their work. It is a notable fact that the application of such conditions in these professions has not only improved the general standard of work done, but also made it more possible for those concerned to secure adequate financial remuneration for their labours.

The milk and dairy industries are responsible for the production of a food stuff upon which the lives of our infants and young children depend. The success of welfare centres throughout the country hangs ultimately upon them. The question which must soon be answered is whether they will allow the public to attempt to force them to adopt more satisfactory methods of production and distribution of milk, or whether they will assert the dignity of their work and take the matter into their own hands, thus saving waste, and vastly improving the status of their profession.

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APPENDIX I.

Average uncooled Milk.

Date	Temp. in churn	No of days sweet at laboratory temperature	Laboratory temperature		No of days sweet at cellar temperature	Cellar temperature		No of days sweet at ice chest temperature	Ice chest temperature	
			Min °F	Max °F.		Min °F	Max °F		Min. °F.	Max °F.
May 31, 1917	80	Under 24 hours	60	70	1	56	59	6	33·5	37
June 7, "	84	" " "	59·5	74·5	Under 24 hours	57·5	59	6	34	37
June 14, "	85	" " "	66·5	75	" "	60	64·5	7	33·5	37
June 15, "	84	" " "	66	76	1	61	64·5	8	33·5	37
June 19, "	80	" " "	63	76	1	61	66	6	33·5	37
June 25, "	84	" " "	60	67·5	1	57·5	59	8	32	37
June 27, "	80	1	58	68·5	1	57·5	61	7	32	37
June 28, "	84	Under 24 hours	58	68·5	Under 24 hours	58·5	61	6	32	37
July 5, "	83	1	57	70	2	57	59	7	33	36
July 12, "	82	Under 24 hours	58	72	Under 24 hours	57	58·5	11	32	36
July 19, "	82	" " "	64	72	1	60	64	10	32	36
July 26, "	82	" " "	66	73	1	62	63	19	33	37
August 2, "	85	1	60	64	1	60	62	13	33	38
August 16, "*	80	Under 24 hours	63	68	Under 24 hours	60	61	9	33	38
Sept. 6, "	84	" " "	59	71	1	59	62·5	7	33·5	37
Sept 28, "	78	1	54	66	1	54·5	59	7	33	36·5
Oct. 11, "	68	3	45	65·5	4	48	51·5	10	33	36
Oct. 18, "	78	3	48	67	3	46·5	53	4	33	36
Oct. 25, "	77	2	44	67	3	45	50	6	33	35
Nov. 1, "	81	1	52	70·5	3	46	57	4	33	36

N.B.—Samples taken from churn three hours after milking.

APPENDIX II.

Clean Milk.

Date	Temp. on arrival	No. of days sweet at laboratory temperature	Laboratory temperature		No. of days sweet at cellar temperature	Cellar temperature		No of days sweet at ice chest temperature	Ice chest temperature	
			Min °F	Max °F		Min °F.	Max.°F		Min. °F.	Max.°F.
May 31, 1917	68	3	57	70	4	54·5	59	11	33·5	37
June 7 ,,	71·6	3	59·5	74·5	4	57	59	11	34	37
June 14, ,,	76	2	66	76	3	60	64·5	8	33·5	37
June 21, ,,	64	2	56	72	3	57	64	14	32	37
June 29. ,,	63	2	57	68	2	57	60	10	32	37[1]
July 5, ,,	69	3	57	70	4	57	59	14	32	36
July 12, ,,	67	2	58	74	2	57	60	15	32	36
July 19. ,,	66	2	64	72	4	60	64	15	32	37
July 26, ,,	71	3	66	73	4	61	65	20	33	37
August 2. ,,	62	3	60	64	3	59	62	13	33	37
August 9. ,,	62	2	62	63	5	60	62	13	33	38
August 16, ,,	65	2	63	68	3	60	61	18	33	38
August 23, ,,	69	3	61	72	3	60	66	16	33	36
August 30, ,,	61	4	59	65	3	58·5	59	15	33	37
Sept. 6, ,,	68	2	59	71	2	59	62·5	14	33·5	37
Sept. 13, ,,	60	3	57	68·5	3	58	59	23	33	37
Sept. 20, ,,	63	3	57·5	71	3	58	62	16	33	37
Sept. 27 ,,	61	4	52	71	5	53·5	63	25	33	36
Oct. 4, ,,	60	4	45	64·5	6	51	59	27	33	36
Oct. 11, ,,	52	6	45	67	8	48	53	29	33	36
Oct 18, ,,	54	3	48	67	5	47	56	14	33	36

[1] This sample was 41½ hours old at testing.

N.B.—Periods are calculated from time of milking.

APPENDIX III.

Bacteriological Examination of 27 samples of Milk supplied to children's Welfare Centres.

No.	Date 1916		Description of shop	No. of bacteria per cubic centimetre[1]	Presence or absence of bacilli coli.[2]	Tubercle
1	July	4	Cowkeeper	98,000	Present	No evidence.
2	"	"	Dairy and Post Office	500,000	"	" "
3	"	"	Dairy selling eggs and butter	3,300,000	"	" "
4	"	11	" " " " "	11,000,000	"	" "
5	"	"	Dairy	860,000	"	" "
6	"	"	"	9,000,000	"	" "
7	"	"	"	700,000	"	" "
8	"	18	Dairy selling biscuits and tinned food	1,190,000	"	" "
9	"	"	Dairy selling eggs, butter, bread, &c.	4,800,000	"	Microscopic evidence confirmed by guinea-pig test.
10	"	"	Cowkeeper	65,400,000	"	No evidence
11	"	"	Dairy selling ham, cheese, butter, &c.	1,070,000	"	" "
12	"	25	Dairy	279,000	"	" "
13	"	"	Dairy selling tea, butter and bread	531 000	"	" "
14	Aug.	29	Dairy	3,695,000	"	" "
15	Sept.	5	"	13,180,000	"	" "
16	"	26	Cowkeeper	2,250,000	"	" "
17	"	"	Restaurant	5,780,000	"	" "
18	"	"	Dairy selling eggs and butter	1,650,000	"	" "
19	"	"	Dairy	8.590,000	"	" "
20	Oct.	9	Cowkeeper	12,960,000	"	" "
21	"	"	Dairy selling ham, eggs, butter, tinned food	20,300,000	"	" "
22	"	"	Dairy	5,000,000	"	" "
23	"	"	"	466,000	"	" "
24	"	16	"	1,564,000	"	Microscopic evidence confirmed by guinea-pig test.
25	"	"	"	300,000	"	No evidence.
26	"	23	"	6,600,000	"	" "
27	Nov.	14	Milk Dealer and General Provision Merchant	104,300,000	"	" "

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[1] In America certified milk must not contain more than 10,000 organisms per cc.; second-class milk not more than 100,000.
[2] Bacilli coli are evidence of dirt contamination.

APPENDIX IV.

Supply, Midweek in month of		Farm I.	Farm II.
November	1915	391	219
December	„	270	162
January	1916	272	168
February	„	257	199
March	„	355	315
April	„	436	328
May	„	630	437
June	„	664	650
July	„	643	501
August	„	553	398
September	„	541	307
October	„	520	261
Contract quantities	Max.	595 gallons per week	350 gallons per week
	Min	301 „ „ ,	210 „ „ „

SWINE FEVER.

THE CAUSE OF THE DISEASE.

A GOOD many points in connection with swine fever are still in doubt, but it has long been known with certainty that it spreads by contagion. It follows from this that the cause of the disease must be a living organism which multiplies in the bodies of infected animals and is passed on from the diseased to the healthy. In what may be termed the pre-bacteriological days of pathology nothing more precise than this could be said of the cause of any of the contagious or infectious diseases of man or the lower animals, and in the absence of any knowledge regarding the nature or form of the cause it was vaguely termed the "virus" of the disease. The methods of investigation which were introduced by Pasteur and Koch gradually showed that in the case of many diseases what had previously been called the virus was a micro-parasite, large enough to be seen with the microscope in the blood or tissues of diseased subjects, capable of being cultivated artificially outside the body, and able to determine an attack of the disease when experimentally introduced into the bodies of susceptible animals. In this way it was proved that different species of bacteria, each possessing distinctive characters, were respectively the cause of anthrax, glanders, tuberculosis, &c., and naturally thereafter the word virus dropped out of use in speaking of the cause of these diseases.

Unfortunately there are still over a score of contagious or infectious diseases of man and the domesticated animals in which all attempts to discover a demonstrable bacterium or other micro-parasite as the cause have hitherto failed, and one of these is swine fever. In speaking of the cause of that disease, therefore, one has still to use the term "virus."

In nearly all the diseases of this group evidence has been produced which makes it probable that the virus is invisible because of the very minute size of the individual bacteria of which it is presumably composed. In favour of this view it may be said that there is nothing *a priori* improbable about it, for although the known bacteria, such as those of anthrax, glanders, and tuberculosis, are very small things, there does not appear to be any sound reason for denying that bacteria twenty times smaller may exist in nature. But the actual evidence that the living things which constitute the virus of swine fever and other diseases of this class are exceptionally minute is that they pass readily through filters which arrest any of the visible bacteria. It is easy to show, for example, that if one mixes together in water, in the same tube, some blood from a case of swine fever (which must contain the virus since it can be successfully used to infect a pig with the disease), and large numbers of the bacilli of glanders or tuberculosis, and passes the mixture through an appropriate filter, the liquid which comes through contains neither glanders nor tubercle bacilli, but does contain some of the germs of swine fever, since it causes swine fever if injected into a pig.

On evidence of this kind the group of diseases referred to above are often said to be caused by ultra-visible organisms, or by filter-passers.

A curious fact with regard to nearly all these filter-passers, including the virus of swine fever, is that they have hitherto resisted all attempts to induce them to grow under what may be termed artificial conditions, outside the body. This is a fact even more to be regretted than their individual invisibility, for an immense amount of knowledge regarding contagious diseases has been gained by studying and experimenting with artificial cultures of the bacteria which are the cause of them. This failure to cultivate the ultra-visible viruses is, of course, not explained by the fact, or hypothesis, that the bacteria of which they are composed are extremely minute, and it must be admitted that no satisfactory explanation of their refusal to multiply outside the body can at present be offered.

Although it is now generally accepted that swine fever is caused by an ultra-visible virus, and not by anything that can be cultivated artificially or made visible with the microscope, it is necessary to refer here to an organism which, on evidence that appeared to be satisfactory, was for a number of years believed to be the cause of the disease, and therefore termed the swine fever bacillus. This bacillus is almost constantly present in the blood of pigs that are seriously ill from swine fever, and it can also be detected in the lymphatic glands and other parts of the body. It is to be noted that if the examination is made immediately after death this organism is not only found in the positions mentioned, but is generally present in a state of purity, unaccompanied by any other visible bacteria. By feeding or inoculating with artificial cultures of this bacillus pigs can be made ill and even fatally infected, and when they die or are killed the post-mortem examination generally shows disease of the intestines indistinguishable from what is common in natural cases of swine fever. In short, it appeared that this must be the cause of swine fever, since it seemed to be constantly present in cases of the disease, and could be successfully used in the form of artificial culture to infect pigs with swine fever. This conclusion had to be abandoned when it was shown (1) that pigs which had recovered from an attack of the disease set up experimentally by this bacillus had no immunity against swine fever, (2) that when a pig was infected experimentally with this bacillus it did not pass the disease on to other pigs kept in contact with it, (3) that the blood of a pig affected with swine fever was capable of causing swine fever when injected into a healthy pig although the so-called swine-fever bacillus was absent from it, as is always the case in the early stages of the disease, and (4) that when the bacillus was present in swine fever blood the latter remained infective although this bacillus and any other visible organisms had been separated from it by filtration, or had been killed by the action of disinfectants.

This bacillus, therefore, is certainly not the cause of swine fever, but the great frequency, not to say absolute constancy, with which it makes its appearance in the blood in cases of swine fever is very remarkable. Moreover, although it is not the actual cause of swine fever, that is to say, not the organism which is handed on from diseased to healthy pigs when the disease is spreading naturally, there are strong reasons for believing that it plays an important part in the pig's illness. That, however, is a point that will be referred to again later.

The fact that the true cause of swine fever is invisible, and cannot be cultivated, places difficulty in the way of ascertaining precisely whether and in what amount it is present in the different parts of the body in cases of the disease. Nevertheless a good deal of information with regard to these points has been provided by experiment. Although it is not exactly known where the virus multiplies at the outset, it has been shown that at a very early stage in the disease, and often before the pig becomes visibly ill, the virus appears in the blood, and that it continues to increase in amount there until the disease reaches its height. It follows from this that soon after the onset of the disease the virus is diffused throughout the whole of the organs and tissues of the body. It has also been ascertained by experiment that the virus may be present in the alimentary canal and in the urine—facts which are of importance in connection with the spread of the disease.

SUSCEPTIBILITY TO THE DISEASE AND METHODS OF INFECTION.

So far as is known, swine fever is a disease absolutely peculiar to the pig. Not only has the disease not been observed to occur naturally in any other species, but it has also been found impossible to transmit it by experiment to other animals than the pig. A contrary opinion was at one time held, but it was founded on the fact that rats, guinea pigs, and some other species could be infected by inoculating them with the so-called swine fever bacillus, which, as has already been shown, is not the cause of swine fever. It may be repeated here that the true cause of the disease is abundantly present in the blood at the height of the disease, and that, although the swine fever bacillus is then also often present, it may easily be separated by filtration. Such filtered blood or serum when injected into a susceptible pig sets up an attack of swine fever, and the pig thus infected will pass the disease on to healthy pigs placed in contact with it. On the other hand, large amounts of such filtered blood or serum may be injected into any of the small animals mentioned, or into any of the other domesticated animals, without any visible effect whatever.

Another important conclusion that appears to be fully justified is that the virus of swine fever is quite incapable of multiplying outside the body of a living pig—in dirt, soil, or water, for example. That follows from the fact already mentioned that the virus has resisted all attempts to induce it to grow under laboratory conditions, however closely these have been made to imitate the conditions prevailing in soil, water, &c.

The facts just stated are important, for they warrant the further conclusion that the virus or material which infects any one pig must have escaped from the body of another pig previously attacked. And this leads to consideration of the ways by which the virus leaves the body of a pig suffering from swine fever.

All that can be said with regard to that is that the urine, the fæces, and the discharge from the eyes have been proved to be infective, and that it is probable that matter coughed up and expelled from the lungs and air passages, and secretions from the skin may also contain the virus. It will be readily understood that from these different sources, but especially from the urine and fæces, an abundance of material capable of spreading the disease is always present in the immediate neighbourhood of a pig suffering from swine fever.

The most certain method of infecting a pig with the disease is to inject a dose (which need not exceed a few drops) of virulent blood under the skin, and, next to that, to place diseased and healthy pigs in the same sty or premises. Feeding with blood, flesh, or other virulent materials is also generally successful in transmitting the disease experimentally, and it appears to be highly probable that the commonest method of natural infection is by swallowing the fresh excrement or urine of diseased pigs. Scraps of raw pork or bacon from diseased but unsuspected animals may be the cause of some outbreaks. It is also possible that infection may occur naturally by the inhalation of minute particles of fæces or other excretions suspended in the air.

In considering the manner in which the disease is spread, however, it is necessary to take account of other points besides the channels by which the virus enters and leaves the bodies of pigs. One of these is the question whether the virus is ever or frequently carried from place to place by men or other animals than infected swine. This question has generally been given an affirmative answer, butchers, pig-dealers, and other persons who have been in contact with diseased pigs being thought capable of carrying the virus in an active condition on their hands, boots, or clothes. Rats have also been accused of carrying the disease from one sty to another. While it cannot be denied that the disease is ever spread in any of these ways, it may be said that infection by such indirect means is probably very rare. It has also been supposed that carts, railway waggons, &c., in which diseased swine have been carried may be dangerous. Opinion with regard to the extent of this danger has had to be modified in consequence of the results obtained in the experiments conducted for the recent Departmental Committee on swine fever in order to test the infectivity of litter or fæces in sties vacated by diseased pigs. These experiments indicated that when the fæces of diseased pigs or the litter soiled with their urine are left to natural influences they rapidly cease to be dangerous. As the point is of special importance it may be stated that in these experiments infection succeeded when healthy pigs were placed on the manure immediately after the diseased pigs had been removed, and in one experiment after seven days; but, on the other hand, negative results were obtained in experiments in which respectively one day, two days, fourteen days, twenty-one days, twenty-eight days, and forty-two days were allowed to elapse before the healthy pigs were placed on the infected manure. It can now be admitted that many thousands of pounds were until lately wasted annually in attempting to disinfect sties which would speedily have become harmless if left to themselves.

The matter may be summed up by saying that the commonest method by which the disease is contracted is direct contact with infected animals, and that beside this all the other ways in which swine fever is spread sink into insignificance.

SYMPTOMS AND COURSE OF THE DISEASE.

Like all other contagious diseases, swine fever varies considerably in regard to the course which it runs. The severity of an attack depends upon a number of factors, the most important of which are the virulence of the infective material or virus, the dose or quantity of this virus, the age of the infected animal, and individual susceptibility.

That the ultra-visible virus, so to speak, varies greatly in its powers for mischief is a fact which must be admitted, though it cannot yet be explained. It is to this cause that one ascribes either the exceptional severity or the exceptional mildness of the disease as compared with what is usually observed in pigs of the same age and breed and kept under similar conditions. Young pigs are more susceptible than older ones, as shown by the severity of the symptoms and the greater proportion of fatal cases among them. The influence of varying doses of the virus is difficult to measure in natural cases, but it is observed in pigs infected experimentally by the injection of varying doses of the same virulent blood.

As a rule the first discoverable evidence of infection, though it is hardly a symptom in the ordinary sense of the word, is a rise of temperature. The normal temperature of the pig varies between 102° and 103° F., and in swine fever it generally rises three or four degrees. This rise usually begins about a week or ten days after natural infection, but it may occur within four or five days, and even within two days, after inoculation with blood. This elevation of temperature is not only the first discoverable evidence of infection, but also the most constant, since it may be detected in mild cases in which outward symptoms of actual illness are never exhibited.

Actual symptoms usually appear soon after, but sometimes accompany, the rise of temperature. They take the form of loss of appetite, dulness, an unwillingness to move, and an inclination to burrow into the litter if that is abundant. As a rule these symptoms become pronounced during the second week after natural infection, but they may appear earlier. Diarrhœa often, but by no means always, sets in, and in fatal cases there is rapidly increasing weakness, in consequence of which the animal sways in its hind-quarters when compelled to move. Thirst is often manifested, although solid food is refused. Sometimes there is a diffuse reddish or livid discolouration of the skin from congestion of the cutaneous vessels. At any time during the period of visible illness an affected animal may develop a cough or begin to breathe rapidly, and these symptoms are usually the result of an attack of pneumonia, which is a comparatively frequent complication of swine fever.

What has just been said represents the train of symptoms usually observed in swine fever, but a fact which is of the greatest importance is that in quite a considerable proportion of cases pigs which become infected develop no outward symptoms of illness. Even in such mild cases there is generally a more or less marked rise of temperature, but probably even that is sometimes absent.

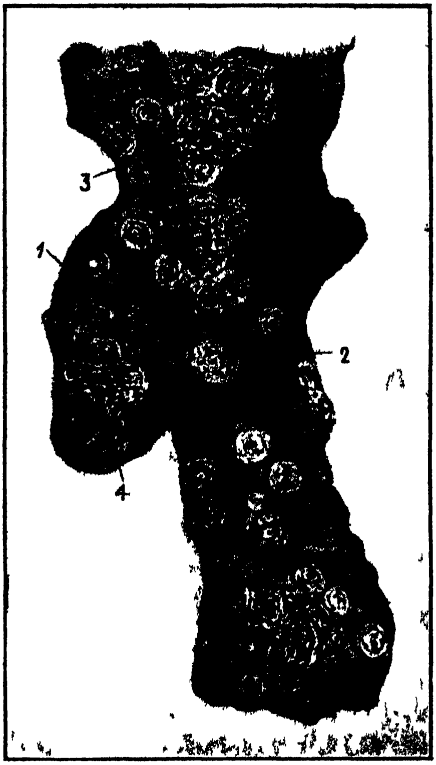
The death rate among pigs which become infected may be anything from 95 per cent. down to 20 per cent., or even less. As a rule death does not occur in less than a week after the onset of symptoms, but it may happen within two or three days, and frequently it is deferred for several weeks if the disease is allowed to run its natural course.

In the animals that survive the recovery is usually a real one, the lesions in the bowel and elsewhere healing up completely, and the virus disappearing from the system. There are reasons for suspecting, however, that some animals make a recovery which is incomplete, with the result that, in spite of apparent health, they are capable of transmitting the disease, or acting as "carriers."

LESIONS.

By the word lesions is here meant the alterations in the appearance and structure of the different parts of the body which are found in cases of swine fever. In very acute cases, especially in those in which death occurs within a day or two after the first signs of illness, the post-mortem examination may show no very pronounced abnormalities, or at least none that are at all characteristic. In such cases one expects to find diffuse inflammation of the stomach and intestines, especially of the large intestine, congestion of the lymphatic glands of the body generally, and small hæmorrhages in the kidneys, serous membranes, and other places.

In the immense majority of cases of swine fever, however, in which visible symptoms of illness have been exhibited for more than two or three days, a post-mortem examination will show lesions that are very distinctive in character. These lesions are found with greatest constancy in the large intestine, and especially in its anterior part. In the moderately acute cases, or in those killed at a comparatively early stage of the disease, one often finds that the large intestine is diffusely inflamed, and that the mucous membrane has adherent to it a whitish or yellowish material, somewhat similar in appearance to the membrane which forms in the throat in cases of diphtheria



Part of the large intestine of a pig laid open to show the ulcers of swine fever 1 and 2, sharply defined single ulcers 3 and 4, large patches formed by confluence of a number of ulcers (About half the natural size) in the human subject. This type of disease in the intestines in swine fever is therefore called the diphtheritic type.

In most cases of swine fever, however, the lesions present at the time of death are of what is termed the ulcerative type, the usual appearance of which is shown in the accompanying figure. The so-called swine fever ulcers are rounded spots or patches, which usually vary in diameter from about half an inch downwards, but in exceptional cases some of them attain a much larger size. These patches are in fact circular areas of the lining membrane of the bowel which have undergone necrosis, that is to say, the patch of tissue is dead or mortified.

In the condition in which they are most commonly encountered these lesions are thus, strictly speaking, not ulcers, but if a diseased pig survives for a sufficient time they become converted into genuine ulcers, owing to the shedding or casting off of the mortified piece as a slough. Whereas in the early stage the rounded patches generally stand a little above the normal level of the mucous membrane, the genuine ulcer produced by detachment of the slough is a shallow depression. In cases of actual recovery from swine fever these ulcers heal up, but for a considerable time afterwards their situation is marked by a smooth scar or depression on the lining membrane of the bowel. By the detection of such scars in the bowel one may recognise that a pig apparently healthy at the time of slaughter has some time previously suffered from an attack of the disease.

Although the bowel is the commonest situation of these ulcers they are occasionally found in the stomach, on the tongue, and in the throat, and in very rare cases similar lesions have been observed on the skin.

Lastly, it ought to be said that not infrequently the diphtheritic and the ulcerative types of lesions are present in the same pig.

Other lesions which are not uncommon, though far less frequent than those just described, affect the lungs. The disease here takes the form of a pneumonia which tends to run its course rapidly, and lead to extensive consolidation of the lung tissue. Pleurisy often accompanies this pneumonia.

Reference must here be made again to the so-called swine fever bacillus, and to the part which it plays in the causation of the disease. As previously stated, pigs can be infected with artificial cultures of this organism, and in pigs so infected lesions develop in the intestine which cannot be distinguished from those found in natural cases of swine fever. To explain this fact it appears to be necessary to assume that, although diphtheritic inflammation and ulceration are the most characteristic post-mortem signs of swine fever, these lesions are not produced by the ultra-visible virus which is the true cause of the disease, but by this swine fever bacillus, which plays the part of a secondary invader. It may at first sight appear to be scarcely credible that an alteration which is so constantly present that it is generally relied upon as a guide to diagnosis in swine fever is not an essential lesion. It may be stated, however, that in this respect swine fever does not stand alone, there being a few other diseases in which the practically constant lesions are not set up by the actual cause of the disease, but by other bacteria which play the part of secondary invaders.

The so-called swine fever bacillus appears to be a common, if not constant, inhabitant of the intestines in the pig, and ordinarily it multiplies there to only a limited extent, does not invade the body, and therefore causes no disturbance of health. As a result, however, of the multiplication of the true virus of swine fever in the blood, the pig's resistance to infection with the bacilli from the intestine is weakened, and these begin to invade the intestinal wall, to cause inflammation and necrosis of the mucous membrane, and later on to invade the body generally to a greater or less extent.

Similarly, the evidence appears to show that the pneumonia which is so frequently met with in fatal cases of swine fever is not an essential or primary lesion, but is caused by another visible organism which is probably always present in the air passages of healthy pigs. The pneumonia which is caused by this bacillus was for many years described as an independent disease by Continental authors, and termed swine plague or contagious pneumonia of the pig. That this view was erroneous, at least with regard to cases of pneumonia occurring among pigs in Great Britain, and that such pneumonia was generally, if not invariably, a mere complication of swine fever, was first pointed out by the Departmental Committee which investigated the subject in 1897.

METHODS OF DEALING WITH THE DISEASE.

The Policy of General Slaughter.—At the end of October, 1893, swine fever, which during the previous fifteen years had been dealt with by the local authorities, was taken in hand by the Board of Agriculture, and from that date until two years ago it was opposed by measures ostensibly designed to stamp it out. During what may be termed the *régime* of the local authorities the number of outbreaks reported annually varied from 1,717 (in 1881) to 7,926 (in 1885). During the last complete year before the disease was dealt with directly by the Board the outbreaks numbered 2,748. During the three years 1914-16 the confirmed outbreaks numbered 12,681, or an average of over 4,000 for each of these years.

The accompanying chart shows the fluctuations in the number of outbreaks from the beginning of the stamping-out system of dealing with the disease down to the close of the past year, and also the numbers of pigs slaughtered as diseased or exposed to infection during the period.

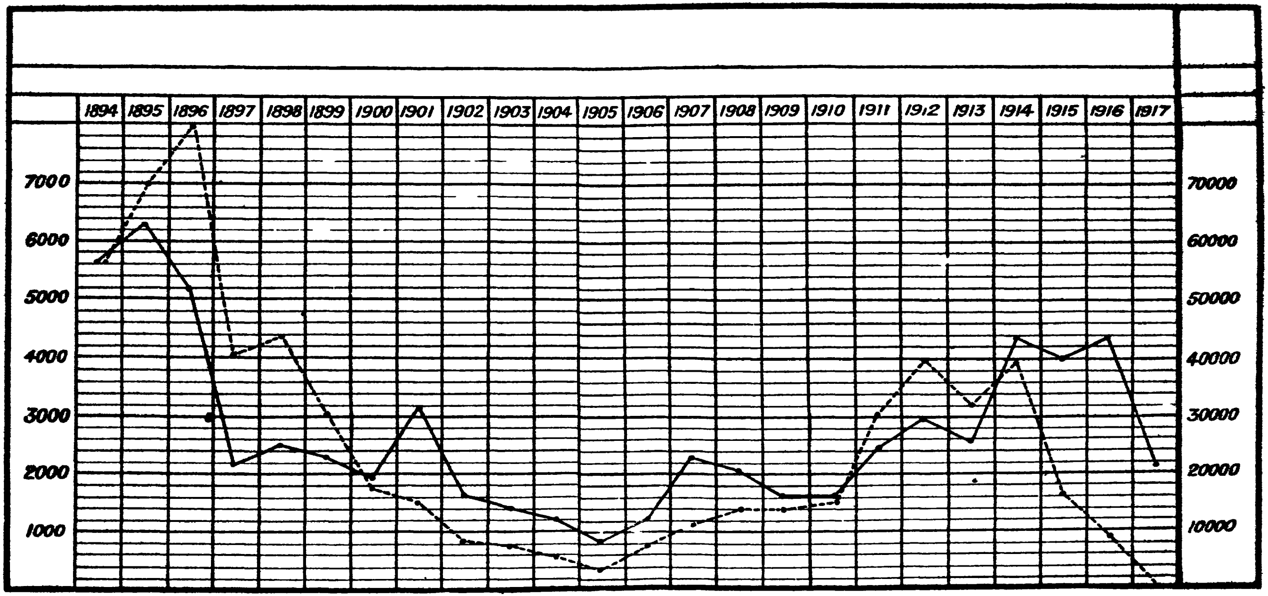
It is beyond all argument that, in so far as the various swine fever orders have been framed with a view to the complete eradication of the disease, the action of the Board has been a complete failure.

It is unfortunately impossible to compare the number of outbreaks in the years 1879–1892 with those for the period 1894–1917 in order to estimate to what extent, if at all, the outbreaks have been reduced since the disease was dealt with directly by the Board. Such a comparison is impossible, because in the former period the outbreaks were "reported," and in the latter "confirmed." At least in recent years the method of diagnosis has been both searching and uniform, and it may fairly be assumed that since 1907 the confirmed annual outbreaks give an approximately correct measure of the prevalence of the disease. On the other hand, while the disease was dealt with by the local authorities the methods of diagnosis were far from trustworthy, and the errors were mainly in the direction of including cases which had nothing to do with swine fever. An accurate comparison is also impossible because the obligation of owners to report has probably been better observed since 1893.

But when full allowance is made for these facts, it still appears not at all unlikely that the disease is as prevalent now as it was before the Board dealt with it directly. And it must be remembered that the failure has been a very costly one, even if one does not include the loss occasioned by the severe restrictions on the sale and movement of healthy pigs, which could never have been justified except on the prospect that they would lead to the stamping out of the disease.

There is room for difference of opinion as to whether the eradication of the disease was actually possible, or possible only at a cost exceeding the national loss which it causes, but there can be little doubt regarding the cause of the failure. The drastic plan of slaughtering all the pigs at any place where the disease had been diagnosed was a sure way of stamping out every discovered outbreak, and if this had been continued, and combined with proper restrictions on movement, the disease might have been finally extirpated. As the chart shows, however, this policy was not consistently followed, and for a number of years prior to 1915 the slaughter of all suspected pigs was not strictly enforced. Eradication may have been problematical before, but it became impossible under the altered system.

CHART.



The continuous line shows the number of outbreaks in each year, and the interrupted line the number of swine slaughtered in connection with the outbreaks during the period 1894-1917 The values of the different points in the line denoting outbreaks are indicated by the figures on the left, and those for the swine slaughtered on the right

A share of the blame for failure may, however, be laid on other shoulders, for it is evident that even so-called cattle plague measures were bound to fail if in any considerable proportion of cases the existence of the disease was not promptly reported. That concealment was pretty frequently practised is scarcely open to doubt.

In conformity with the recommendation made by the Departmental Committee in 1915, the attempt to extirpate the disease by general slaughter has been abandoned "for the present," and probably no one saddled with any responsibility for the results will venture to advise its revival.

The Control of the Disease by the Use of Serum.—Before considering the part which serum treatment is capable of playing in attempting to control swine fever it appears to be desirable to explain briefly the principal facts connected with the production of what are called "anti-sera" in general.

As is well known, it is a general rule that when a man or an animal has recovered from an attack of a bacterial disease the person or animal in question is for a variable time afterwards more or less immune against a second infection with the same organism. Immunity which is acquired in this way is termed "active." In some cases it is possible to show by experiment that this immunity depends upon something which has appeared in the animal's blood, and which continues to circulate there after recovery. Proof of this may be furnished by injecting some blood, or blood serum, from the recovered animal into a normal non-immune animal of the same species, and immediately afterwards inoculating the latter with the bacteria which are the cause of the disease in question. Provided a large dose of blood or serum has been used in such circumstances, the experiment may show that in consequence of the injection the previously susceptible animal has acquired some immunity. The immunity obtained in this way is termed "passive." Knowledge of this fact would suggest that in practice one might use the blood of recovered animals for inoculating and immunising healthy animals against various contagious diseases. This, however, is not practicable, because, although the immunising substance occurs in the blood of animals that have recovered from a natural attack, it is never present there in great amount, and, consequently, too large a quantity of blood would have to be transferred to a healthy animal in order to give it protection. This difficulty, however, can in many cases be overcome by resorting to what is termed "hyper-immunisation." In carrying this out one may select a full grown healthy animal which already has some immunity in consequence of recovery from a first attack, and inject it subcutaneously or intravenously with a dose of the organism which is the cause of the disease. In all probability, in spite of the animal's immunity, the injection will provoke some considerable disturbance. When such disturbance has passed away the animal is given a second and larger dose of virus or bacteria, and this process is repeated many times, the dose of bacteria or virus being gradually increased. The effect of this procedure is to stimulate the production of the substance upon which immunity depends, and after a time, which may often have to be several months, the blood of the hyper-immunised animal becomes so enormously rich in the protective substance that only a small dose of it is required in order to immunise a healthy animal.

In the case of diseases that are caused by visible bacteria which can be cultivated artificially, cultures are naturally always used in the process of immunising, that is to say, the animal is treated at intervals with steadily increasing doses of artificial culture. When, however, as is the case in swine fever, the cause of the disease cannot be cultivated outside the body, one has to use the fresh blood or other material from a diseased animal, which is known to contain the virus in large quantity.

Finally, as a general point, it ought to be stated that the animal which is to be employed as a serum producer must be naturally susceptible to the disease against which the serum is to be used, for if an animal already possesses natural immunity against a given disease injection of the bacteria of that disease into its body will not cause it to manufacture any protective substance.

Turning now to the particular case of swine fever, it may suffice to say that the serum is obtained from selected healthy pigs, which are given successive doses of virulent swine fever blood. At a place where serum has to be produced on a large scale it is therefore necessary to have a constant supply of such blood, and in order to provide it relays of pigs are infected with swine fever, and bled to death when the disease is at its height.

Unfortunately no other animal can be used for the purpose of providing infected blood, because, as already mentioned, the pig is the only animal known to be susceptible to swine fever.

The fundamental facts with regard to the powers of the serum are (1) that when given in sufficient dose to a healthy pig it renders the animal highly immune to swine fever for a time, (2) that this immunity steadily declines, and is so diminished as to be of no practical value after about ten days, (3) that the serum may be successfully employed to prevent the development of the disease, or to make the resulting attack non-dangerous, if it is given within a few days after infection,

(4) that the serum is of no value for curing the disease in a pig that is already seriously ill.

It will be obvious that it is not advisable to use serum for pigs that are known to be healthy, and are not likely to be exposed to any risk of infection, for the immunity conveyed by the serum soon disappears. On the other hand, the serum may be used with advantage for the apparently healthy pigs on premises where the disease has already shown itself, and also for healthy pigs when there are strong grounds for fearing that some of them may have caught the infection.

Towards the end of September, 1915, when the policy of attempting to stamp out the disease by slaughtering all diseased and suspected pigs was abandoned, serum was introduced by the Board as a means of dealing with outbreaks. In outline the plan now followed is as follows:—

All Veterinary Inspectors are provided with a supply of serum from the Board's laboratory. When the Board receives intimation that swine fever is suspected to exist at any place the nearest Veterinary Inspector is instructed to visit the premises and make a diagnosis, taking with him a reasonable supply of serum. Should he diagnose swine fever he is authorised to carry out treatment with serum if the owner agrees, without waiting for confirmation of his diagnosis by the Board. Meanwhile parts from some of the suspected pigs are sent on to the Board's laboratory, and when the Veterinary Inspector has in the first instance reported that disease did not exist, and this opinion is found to have been incorrect by the investigation at the laboratory, the Inspector is immediately instructed to re-visit and offer serum treatment.

The acceptance of serum treatment by the owner is at his option. When he accepts and the treatment is applied to all or a portion of his pigs he is advised to allow the healthy pigs treated on the infected parts of the premises to mix with the affected pigs, in order that the former may become infected by contact while still under the influence of the serum. As the immunity conveyed by the serum only lasts for about ten days, after which the pigs again become susceptible to swine fever in a fatal form if they have not previously become infected by contact, the only alternative to allowing the treated pigs to mix with the ailing is to give repeated doses of serum until all the ailing are dead or recovered. That, however, is not resorted to except when large numbers of healthy pigs are suspected and it is impossible to bring about proper mixing between the diseased and the healthy.

After the administration of the serum Veterinary Inspectors pay periodical visits to the outbreaks and report as to the condition of the pigs.

Healthy pigs may by licence be moved off infected premises for immediate slaughter, and other pigs may be moved on for fattening purposes, the latter being usually treated with serum on arrival. The owner is thus able to continue his pig-feeding business although infection may be present on his premises.

It is important to observe that no ailing or suspected pigs are slaughtered or compensated for except such as are destroyed by the Veterinary Inspector in order to enable him to arrive at a definite diagnosis by post-mortem examination.

Furthermore, in considering what follows the acceptance of serum treatment by an owner, it must also be noted that when the treatment is refused restrictions on the movement of pigs to or from the infected premises are imposed, and the owner is simply given the option of allowing the disease to run its course or to slaughter his pigs for the market at his own risk.

Whether serum treatment is accepted or refused the restrictions on the movement of pigs to or from the infected premises are maintained until in the opinion of the Board the disease has ceased to exist there.

Information with regard to the results of the serum treatment for the past year have not yet been published, but apparently during the year after its introduction (September, 1915) only about half the owners on whose premises swine fever was diagnosed agreed to the use of serum.[1] During this period the treatment was applied to 2,100 outbreaks, in which 77,900 pigs were involved, and when the results were compared with those obtained in outbreaks in which serum was not used it appeared that there was a marked advantage in the employment of serum.

It cannot be claimed that it would be to the advantage of every owner to agree to the serum treatment, for when the disease has been diagnosed and the surviving apparently healthy pigs are of the proper age and condition it will probably always be best for the owner to slaughter out for the butcher, and after a brief interval re-stock. When, on the other hand, the infected herd includes valuable breeding animals, or stores of various ages that are not yet fit for the butcher, he will be well advised to decide in favour of the serum treatment.

It must be admitted, however, that there are unsolved difficulties in the treatment of outbreaks in which the herd already includes sucking or recently weaned pigs, or sows that are due to farrow within the next month or two, for hitherto the mortality among very young animals exposed to infection has been very serious (up to 25 per cent.) in spite of serum treatment.

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[1] Annual Report of the Chief Veterinary Officer for the year 1916.

A very serious handicap to the serum treatment of outbreaks, and indeed to any method of dealing with the disease, is that in very many cases the infection has already spread to a considerable proportion of the pigs on the premises before the suspected existence of the disease is reported How injuriously this affects the results will be understood when it is remembered that the serum is useless as a curative, and apparently of very little value in the case of animals that are near the end of the period of incubation. Experience so far has indicated that on an average about 30 per cent. of the pigs still alive are in this more or less hopeless condition before the serum is injected. As the remedy for this is entirely in the hands of owners, the advantage to themselves of prompt reporting cannot be too strongly emphasised.

A suspicion of swine fever should always be entertained when any new pigs have been recently brought on to the premises. If possible such animals ought to be isolated for several weeks, and inspected daily for signs of ill health. The critical period is the second week after arrival, but, of course, the disease may show itself before that. The owner should remember that it is not the existence of swine fever, but the suspicion of it, that he has to report, and that when recently purchased pigs appear ailing it is better not to wait for what he may consider the decided symptoms of the disease.

There remains to be mentioned a method of employing serum which is different from the one just described. This consists in inoculating pigs simultaneously with serum and with virulent blood. What is expected from this operation is that the attack of swine fever caused by the virulent blood will be held in check by the serum, with the result that the disease will be mild and non-dangerous, but leave a strong and lasting immunity. Unfortunately this result is not obtained in every case, and although the losses caused by the operation itself vary greatly they probably cannot be placed at less than 5 per cent. on an average among pigs under six months old. This method has been practised on a very large scale in the United States of America and in Hungary—countries in which the swine fever is already so diffused, and the facilities for the spread of the infection are so great, that the stamping out of the disease, or even its control by restrictions on movement, is considered impossible. It will be readily understood that in such circumstances the best plan may be to encourage every owner to have the whole of his pigs systematically vaccinated by the above method as soon as they reach a suitable age. It will be equally plain that the method has at present no interest for this country, as if generally practised it would occasion a loss far in excess of what swine fever has caused in the worst years.

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SOME PROBLEMS OF RE-AFFORESTATION.

NO figures are available to show what area of British woodlands has been cleared during the war, but it is common knowledge that felling has been much in excess of normal, while planting operations have perforce been largely suspended. Timber of all kinds has been in demand, but the inroads have undoubtedly been greatest in the case of conifers, and owners of poorly-grown immature Scots pine, spruce, and larch have had an opportunity to realise, at a good price, timber which in pre-war times was practically unsaleable.

Whether the Government will take steps to secure the re-planting of denuded areas remains to be seen, but in any case most owners will want to re-invest a portion of the sum realised from sales, so that the next few years are likely to witness considerable silvicultural activity. Much has been learned in respect of economic forestry during the past twenty or thirty years, and it is well that the results of such experience should be applied to the problems of re-afforestation that lie ahead of us.

There are some who hold that a planter's choice of species should be confined to those which have been almost exclusively relied on in the past. As regards hard woods this decision is a sound one, and one cannot name a single exotic species of hard wood possessed of merits superior, or even equal to, those associated with native or long-acclimatized species. Our native oak, ash, elm, birch, sycamore, willow and poplar grow as fast, are as free from disease, and furnish as good timber as any exotic species of these genera that have been tried. In saying this it is not forgotten that *Alnus incana* possesses certain characteristics not shared by the common alder, *Alnus glutinosa*, inasmuch as it will grow quickly on poor thin chalky soil, and thus prove useful as a nurse to better species. Then, again, a number of exotic and hybrid poplars have been introduced during recent years, and some of them seem to possess great vigour in youth, but whether in the end they will surpass long-tried species, such as the black Italian and the white poplars, cannot at present be determined.

While, therefore, planters are advised to adhere to the species of hardwoods to which they are accustomed, the case is different in regard to conifers. In the past the planter's choice seldom went beyond Scots pine, Norway spruce, and European larch, with the occasional inclusion of silver fir and Corsican pine, and even less frequently of Weymouth and Maritime pines. This statement refers to plantations established thirty or more years ago, and is also limited to forestry on a commercial scale, and has no reference to ornamental planting. But although not planted on a large scale, enough has been done with certain exotic conifers to warrant their taking an important place in present-day silviculture. The newer conifers whose merits entitle them to attention on economic grounds are, in the first instance, the Douglas fir, the Sitka spruce, and the Japanese larch; and, to a much less extent, *Abies grandis*, *Tsuga Albertiana* (=*Mertensiana*), *Pinus insignis* (=*radiata*), and *Thuja gigantea* (=*plicata*).

There are some who urge that native trees alone should be depended on for commercial afforestation, forgetting that such trees, for instance, as the common larch and spruce, are no more natives than those that have just been mentioned, the only difference being that they happened to be introduced somewhat earlier. The list of forest trees—that is, trees attaining to timber dimensions—strictly indigenous to this country is a very short one. Of conifers, there are only the Scots pine and yew; while of hardwoods there are the sessile and pedunculate oaks, the beech, the ash, the wych elm, the birch, the alder, the aspen and the cherry.

The Douglas Fir.—Introduced from North-West America in 1828, this tree has been extensively planted in parks and arboreta. It has also been used to a certain extent in mixed plantations, and there are a few examples of pure woods of this species up to sixty years of age. The only two objections that can be urged against the Douglas fir are, first, that it does not thrive well upon a soil containing a high percentage of lime, and second, that, in exposed situations, its top and branches are apt to be broken by wind. As regards its antipathy to lime it may be said that an instance has recently been described[1] which shows that even on the most pronouncedly calcareous soil of all, namely chalk, fair success has been obtained with Douglas fir. The surface, however, was covered to a depth of 2 or 3 inches with the accumulated leaf-mould of a former crop of beech. As to the frequency with which the top is broken by wind, it may be remarked that this loss generally occurs either in the case of solitary trees, or of trees thinly scattered throughout a wood. The Douglas fir usually grows faster than any species with which it may be mixed, and its top is therefore much exposed to the influence of gales. If, however, this species is grown in pure woods, one tree shelters another, and, except along the margin of the plantation, or on a hillside fully exposed to the south-west gales, the disadvantage referred to is not serious.

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[1] *Quarterly Journal of Forestry*, Vol. xi., 1917, pp. 1 and 189.

These drawbacks are much more than counterbalanced by the many merits possessed by this tree. In quality the wood is much superior to Scotch pine or spruce; in fact, in point of durability it closely approaches larch, which it also resembles in colour and texture. In some parts of Scotland, before the war, a good deal of Douglas fir up to fifty years old was being put on the market, merchants often buying it at the price of Scots pine and spruce. On being asked as to the uses to which it was put, a forester remarked that it went into the sawmill as Douglas fir, but it all came out as *larch* posts and rails!

Not only is Douglas fir timber of the highest value for general estate purposes, but it also furnishes excellent pit wood, and, when of sufficient size, it is unsurpassed for all high-class structural purposes. Its merits have now been thoroughly recognised in the timber trade, and Douglas fir—or Oregon pine, as it is often called—now takes a very high place in the lumber industry of the United States and Canada.

But, high as is the quality of the timber of this species, the volume of timber produced per acre is even more remarkable. Volume xx. of the *Journal of the Board of Agriculture* for 1913–14 contains the results of measurements of six plantations of pure Douglas fir in Scotland, England, and Wales, and the following is an abstract of the principal facts obtained.

Estate	County	Age	Mean height of dominant crop	True volume per acre over bark *	Value per cubic ft.	Value of standing crop per acre	Average annual growth in volume per acre in cub. ft.
			Ft.	Cub. ft.	*d.*	£	*
Taymount .	Perth . .	52	88	8,460	5⅓	188	163
Lochwillan.	Carnarvon .	58	101	14,110	6	353	243
Llandinam.	Montgomery	28	66	7,960	4⅕	139	284
Tortworth .	Gloucester .	43	97	9,320	6	233	217
Do. .	Do. .	29	66	4,700	4	78	162
Dunster .	Somerset .	33	74	6,350	6	159	192

From the year of planting these six woods have given an average annual growth in volume of 162 cub. ft. per acre as a minimum and 284 cub. ft. as a maximum. To appreciate the full significance of these figures we must compare them with the yield of other conifers grown under average conditions. Thus, Scots pine grown on average land will have done well if, at fifty years, it shows a total growing stock per acre of 2,500 to 3,000 cub. ft. (true volume), the corresponding figures for Norway spruce being 3,500 to 4,000 cub. ft. In the former case the average annual increment is 55 cub. ft., and in the latter 75 cub. ft., so that even the least productive of the Douglas fir plantations has given three times as much yield as an average Scots pine wood, while the best has produced more than five times as much timber.

It may confidently be asserted that no tree is capable of furnishing such a high yield per acre as Douglas fir, and it should therefore be extensively planted wherever the conditions are at all favourable.

Sitka Spruce.—This is a tree whose native habitat is confined to the bottoms of the valleys on the Pacific seaboard of Canada and the United States. Introduced into Britain in 1831, it has been extensively planted, for the most part as specimen trees, in many districts. At Durris in Aberdeenshire it has proved superior to all other species at an altitude of 1,000 ft., and it has also given an excellent account of itself on land too wet and too peaty to suit most trees. On hot, thin, dry chalk in Sussex I find that the Sitka spruce is as promising as any species, but the woods are too young to warrant a final judgment as to its success under these trying conditions.

There being no pure woods of Sitka spruce of any considerable extent in this country it is impossible to quote acreage volume figures, as in the case of the Douglas fir, but both in height and in volume it surpasses the common spruce. Mr. Crozier, who has had unusual opportunities for studying the growth of the Sitka spruce in Scotland, states[1] that this tree has grown at an altitude of 750 to 800 ft., in a mixed plantation, so much faster than the common spruce that before the seventeenth or eighteenth year the latter species had been largely overgrown and suppressed. At this age the Sitka spruces were 46 to 50 ft. in height, as compared with 35 ft. for the tallest specimens of the common spruce. He gives it as his opinion that Sitka spruce, in pure woods, and assuming favourable conditions, should yield 6,000 cub. ft. per acre of timber (quarter girth measure) at thirty-one years, and 10,000 ft. by the fifty-fifth year. Such yields compare not unfavourably even with those of Douglas fir. In the same volume of the *Transactions of the R.S.A.S.* Mr. H. M. Cadell, drawing on his experience up to an altitude of 550 ft. in Stirlingshire, states that the Japanese larch and Sitka spruce have grown about equally fast and have far outstripped all the other species. In Vol. xxviii. of the same *Transactions*, Mr. A. C. Forbes expresses the opinion "that the value of Sitka spruce for planting on the exposed sites and wet soils which occupy so large a proportion of the surface of Ireland can scarcely be over-estimated."

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[1] *Trans. Roy. Scot. Arb. Soc.*, Vol. xxiii., p. 12

While the timber is inferior in respect of durability to that of the Douglas fir, it is at least as valuable as that of the common spruce, and under the name of the Silver Spruce it has a very high reputation for the construction of aeroplanes. The name Silver Spruce—not to be confounded with silver fir—is derived from the silvery or glaucous appearance of the foliage, a fact which gives the tree a high decorative value.

When grown singly the Sitka spruce forms strong side branches, and under these circumstances the stem is very coarse and knotty. It should therefore be planted fairly close, and thinning should not start till somewhat late, and should be moderate in extent. In woods of similar density it is said to clean itself better than common spruce and is much more resistant to wind.

The Japanese Larch.—This species was introduced in 1861, and there are now many pure plantations up to twenty years of age. Possibly this tree will not in later life attain to the dimensions of the European larch, but in the first twenty to thirty years it almost invariably surpasses the common larch both in height and in volume per acre. In quality of timber there is no appreciable difference between the two species, but there are certain other points of distinction to be noted. As compared with the common species, the Japanese larch has stronger side branches, and the stem is scarcely so straight. These are characteristics in which it is inferior; but, on the other hand, it grows much faster in youth, suppresses ground vegetation much more completely, forms a denser layer of humus, is practically immune to disease, grows on a wider range of soils—on poor chalk it is much superior—and recovers from such an injury as snow-breaking much more quickly and completely. It is also more decorative than the common larch, its foliage being longer and more silvery, while its young branches are of a warm cinnamon brown colour. There are few finer sights in nature than a young wood of Japanese larches when the ground is covered with snow, against which the young shoots make a very striking show of colour.

For a short rotation, designed for the supply of pit props or light fencing material, no species of tree can excel the Japanese larch, and as a nurse, to be removed when about twenty years old, it is of high value.

Mr. C. P. Ackers in Vol. vi. of the *Quarterly Journal of Forestry* draws attention to the inferior power of resistance of the Japanese larch in Gloucestershire to the excessive drought of 1911. In the North of England in the same year it was little affected, and his conclusion is that "the Japanese larch promises to become a far more useful tree than the European, and to give a crop of useful timber where the European could never pay."

The possibilities of the Japanese larch are well shown in the report of the Judges on the Competition of Plantations in Yorkshire in connection with the Royal Agricultural Society's Show at Doncaster in 1912.[1] At the age of ten years the First Prize plantation, at an altitude of 800 to 850 ft., had an average height of 17 to 18 ft., with a girth in the middle of the stem of 8 to 10 in. There was no trace of disease, and the accumulation of leaf mould on the surface of the ground, combined with complete suppression of surface growth, was very remarkable. In the *Quarterly Journal of Forestry* for July, 1917, Mr. W. B. Havelock gives certain measurements of trees in a wood of Japanese larch at Brocklesby, Lincolnshire. These were planted in January, 1900, and after seventeen years' growth the height was 40 to 45 ft., and the average girth at 5 ft. from the ground, was 19 in.

Abies grandis.—This is perhaps the fastest-growing of the silver firs, and it is least affected by "*aphis*," which makes the common silver fir so difficult to establish even under a shelter wood. All silver firs, however, are very sensitive to spring frost, and their growth in youth is slow, so that they are not so attractive from the commercial point of view as certain other genera of conifers. They all bear a large amount of shade, and are useful for underplanting. Their timber is inferior to that of the spruce, but, given suitable conditions, some of them, notably *A. grandis*, will give a much larger yield per acre.

The Western Hemlock, *Tsuga Albertiana* (=*Mertensiana*) grows with great rapidity in most parts of the country, provided the soil is not calcareous. It is much superior to the Canadian hemlock (*T. canadensis*), which seldom retains a good leader, and is apt to take the form of an overgrown bush. The Western hemlock, on the other hand, has a particularly straight stem, and although its leading shoot is apparently so delicate, it is rarely broken by the wind. The timber may be classed with spruce.

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[1] R.A.S.E. Journal, Vol. 73, 1912, p. 220.

Pinus insignis (=*radiata*) is not hardy enough for general planting, but in the south and south-west of England, in the south-west of Scotland, and over a large part of Ireland, especially near the coast, it grows with great vigour, and in a short time, forms a large quantity of timber, not, however, of the highest quality. Mr. B. W. Adkin has given some figures as to the relative rate of growth of this tree. In Cornwall, near Newquay, in a mixed plantation the common spruce averaged 3 ft. in girth, Scotch pine 3 ft. 4 in., Spanish chestnut 2 ft. 8 in. to 3 ft., and *P. insignis* 5 ft. 4 in. to 5 ft. 8 in. In a wood near Penzance *P. pinaster* girthed 2 ft. to 3 ft. and *P. insignis* 3 ft. to 4 ft. "In Hampshire also the *P. insignis* have quite double as fast a growth as larch, though the larch grows to perfection." At Muckross, near Killarney, in a wood 45 years old "the larch are undoubtedly fine, but the pine (*P. insignis*) is nearly double the diameter of the larch, and no doubt contains three or four times as much timber."[1]

Thuja gigantea (=*plicata*), the Red Cedar of Western Canada, is held in high esteem by certain planters in this country. It is quite hardy, grows fast, is highly decorative, and yields fine red durable timber, which, in the tree's native country, is chiefly used for shingles, a purpose at present of no account in this country. There is a mixed wood of *T. gigantea* and Douglas fir on the estate of Benmore, Argyllshire, planted in the winter of 1876–77. In 1911 the Douglas fir averaged about 70 ft. in height, and *T. gigantea* 10 ft. less. A sample area was measured in that year,[2] there being 890 stems per acre, half of which were Douglas fir and half *T. gigantea.* "The volume of timber per acre, according to quarter-girth measurement to 5 in. diameter, deducting 1 in. for bark, is as follows :—Douglas fir, 5,000 cub. ft. per acre, and *T. gigantea* 2,430 cub. ft. per acre. This gives a total of 7,430 cub. ft. per acre, and although the Douglas fir has proved much superior to the other, the yield of *T. gigantea* compares favourably with that of many other species.

The Corsican Pine (*Pinus laricio*) with its varieties, the Taurian and Calabrian, is not a new species, having been introduced into this country over 150 years ago, but it is one whose merits deserve wider recognition. On strongish land, and on thin chalk, it grows much better than any other pine, and furnishes timber, which, though somewhat coarser than Scots pine, is equally suitable for general purposes. To appreciate the possibilities of this tree one should see it growing at such a place as Cissbury Rings on the South Downs, some four miles from the sea north of Worthing. Fully exposed to the south-west gales, and on the poorest calcareous soil, trees forty to fifty years old are making a height growth of 1½ ft. a year, their growth being much superior to other species with which they are associated.

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[1] *Quart Journ. For.*, Vol. vi., p. 18.

[2] D. K. M'Beath, *Trans. Roy. Scot. Arb. Soc.*, Vol. xxvii., p. 107.

Other conifers could be mentioned which have proved serviceable under certain conditions. Thus the Weymouth Pine has given a very large yield on poor heathy land in the south of England, but it is now so much affected by the white pine blister that its outlook is very uncertain. The white spruce (*Picea alba*) is reported to grow much better than larch or common spruce at an altitude up to 2,000 ft. near the Cumberland and Northumberland boundary,[1] and it is largely depended on for afforesting the barren heaths of the Danish coast, but it is probable that the Sitka spruce would, as a rule, give superior results.

A few years ago plants of such species as Douglas fir, Japanese larch, and Sitka spruce were quoted in most nursery catalogues at a price that prohibited their use except for ornamental purposes. There is no reason why they should cost appreciably more than Scots pine, common spruce or larch, and now that there is an extensive demand for them nurserymen are raising them in large quantities and offering them at reasonable prices. If, however, a planter contemplates extensive afforestation with any of the species suggested, it would be well to look three or four years ahead, and make a contract at a definite price with a nurseryman, who would thus be able to make favourable terms for the necessary seed, and the plants would ultimately be forthcoming at the lowest possible cost. Or the planter may procure the seed and raise the plants in a home nursery, but success in nursery treatment postulates conditions of soil and management that are not always forthcoming.

A good deal of experimental work has been done of recent years which goes to show that forest trees, whose natural habitat embraces a wide area, have developed varietal characters, and that much of the success of planting may depend on whether one has been fortunate to secure the right variety for any particular locality. The Scots pine, for instance, is distributed over the greater part of Europe and a large portion of Asia, and if seed be obtained from, say, Scotland, Sweden, France, and Switzerland, it will be found that the resultant plants show very different characters in regard to rate and habit of growth and resistance to disease. In this country Scots pines raised from Scottish seed ("native Scotch") give the best results, and many nurserymen have had the experience of burning large "breaks" of pines raised from continental seed, because the plants were so unhealthy as to be unsaleable. Probably such a tree as the Douglas fir, distributed as it is over an immense area in Western America, has also several varieties, indeed two—the Oregon and Colorado—have long been known. Of these, the green (Oregon) variety is by far the better for general purposes, but even this variety may have —in fact is known to have—sub-varieties which vary in value for British conditions. The whole subject is of great importance and should be thoroughly investigated. Meanwhile planters must depend on their judgment in selecting plants by appearance, unless they collect their own seed, in which case healthy well-grown parent trees should alone be utilised.

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[1] A. C Forbes *Royal Commission on Coast Erosion and Afforestation*, Vol. ii., p. 196

A mistake, too often made in the past, should be avoided in future, namely, complicated and irrational mixtures of species. There is, no doubt, a good deal to be said for certain mixtures, where one species is deep-rooted and thus gives support to some shallow-rooted species, or where the ground vegetation is suppressed by a dense-crowned species to the advantage of its light-crowned neighbour. But the difficulties of management are considerably increased when one has to regard the requirements of two kinds of tree in place of one, and the problem becomes almost baffling where there are perhaps half a dozen species equally distributed over the whole area. Often, in the past, the main purpose of a mixture seems simply to have been based on a desire to add variety to the woodland; or it may have been the result of uncertainty as to whether some species or other would succeed on the area. Again, the mixture may have had for its object the production of an early return through the agency of thinnings, as, for instance, where the larch has been used to "nurse" up some species, such as oak, of little value as young timber. This is quite a legitimate purpose, provided too much is not sacrificed in its attainment, but unless the removal of the nursing crop is attended to betimes it may do a great deal more harm than good. A mixture, much in vogue at one time, which looked attractive on paper, but was really opposed to sound principles, consisted in planting about 200 oaks or other hardwoods per acre at, say, 15 ft. intervals, and filling up the ground with some nursing species which were designed to be gradually removed, leaving the oaks to form the final crop. The fallacy of such a mixture consists in this—that it gives no opportunity to select the best formed and most vigorous individuals to constitute the final crop. Under such a system every oak planted must be retained till the end of the rotation, whereas if 1,000 oaks had been planted in the first instance 800 inferior individuals would have been removed in the course of the rotation, and the 200 retained till the end would certainly comprise larger and finer stems. This argument would necessarily be greatly strengthened if the wood were planted pure in the first instance, containing, as it would do, three or four thousand plants; and still more so if it had been established by artificial sowing or by natural regeneration, when perhaps there might have been fifty to a hundred thousand seedlings from which to make the selection of 200 as the main crop. One has only to examine a pure wood of any species to realise how great is the difference in individual characteristics. Broadly speaking, the greater the numbers the greater is the opportunity for selecting high-class stems to form the final crop.

While it is desirable to emphasise the importance of this consideration it is not necessary to push the idea to the extent that one finds in some countries. Thus in some forests in Denmark beeches are planted not as single trees but in bunches of five to fifteen, so that instead of having three or four thousand from which to select, one has five to fifteen times that number.[1] But if this extreme is bad the other, which allows little if any opportunity for selection, is worse.

While the Douglas fir and spruces are generally best grown in pure woods, or, at least in pure groups, there are often advantages in growing such trees as the oak and larch in association with beech. If the land is of a good class for oak this tree will grow well alone, but if the soil is thin, rather light, and dry, much better growth of the oak will be secured by a mixture with beech. Very fine oaks are to be found thinly scattered in beech woods on the Chilterns, Cotswolds, and other limestone areas. Similarly as regards larch, which often reaches its largest dimensions on quite shallow soil if nourished by beech humus. But larch is such a profitable crop, even when of quite moderate dimensions, that, as a rule, it may be planted pure. In making this suggestion it is not forgotten that the common larch is sometimes severely attacked by disease, but it is rare that at the age of twenty to thirty years more than 50 per cent. of the stems are attacked, and infection after that age is unusual, and in no case serious. It is on this fact that the Novar system of combating larch disease is based. On Sir Ronald Munro-Ferguson's estate of Novar, in Easter Ross, the larch is planted alone, and at the age of sixteen to twenty years all diseased and inferior stems are removed, three to five hundred of the best being retained to grow on. Before the war these thinnings realised 20*l.* to 25*l.* per acre. At this stage the wood is underplanted with Douglas fir, Sitka spruce, *Abies grandis*, *Thuja gigantea*, Western hemlock, beech or some other species which will establish itself and grow up under the mild shade of the larch. It is intended to thin the larch again when about forty years old, leaving at that time 100 to 200 trees per acre to grow into heavy timber. At the end of the rotation (sixty to eighty years) both the larch and underwood will be felled, or the underwood be left to grow on till it also is mature.[1]

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[1] *Quart. Journ For.*, Vol iii, p 79.

In regard to initial density of stocking—that is, number of trees planted per acre—it may be said that in the period immediately before the war there was a distinct reaction from the very close planting (about 6,000 plants per acre) that was strenuously advocated twenty years ago. As in so many cases the question is largely one of circumstances. If one is dealing with two-year-old seedlings, costing, say, 8*s.* per 1,000 when planted, one can afford to make a more liberal use than if one is employing four-year-old plants, possibly pitted, costing, it may be, 2*l.* or 3*l.* per 1,000 when in their final position.

An extra thousand trees planted per acre will only affect the very earliest thinnings, and if there is no local demand for small stuff it may not pay to take it out. Of course one gets a complete canopy a year or two earlier by close planting, but if the planting of an extra thousand trees costs 1*l.* per acre one must receive 2*l.* nett per acre more for the thinnings at the eighteenth year if, apart from any problematical benefit to the main crop, one is to secure 4 per cent. on the outlay. Whatever the number of trees that may be planted on Scots pine land of the best class there will only be room for some 1,400 by the twentieth year. Planted 4 ft. by 4 ft. in triangles, 3,144 trees are required to stock an acre, whereas, with interspaces 3 ft. by 3 ft., the number is 5,590. In the former case 1,744 would theoretically have come out as thinnings, in the latter case 4,190; but it may easily happen that the larger individual size of the smaller number may make them the more valuable.

Besides the local market, other factors that should influence one's judgment in regard to density of stocking are (*a*) the quality of the situation, (*b*) the rate of growth and character of the particular species, (*c*) the presence or absence of rank herbage. The poorer the soil the smaller is the average size of each tree, and therefore the larger the number for which there is room. Trees that grow rapidly in youth, like larch, Douglas fir, poplars, &c., need not be so close planted as slower growing species, like oak, spruce, silver fir, &c. If the young plants have to contend with strong herbage—or, indeed, with any prejudicial factor, such as rabbits, or insects—greater density in the stocking is justified, if only to discount a higher death rate. Trees, again, which readily lose their side branches, *e.g.*, larch, need not be crowded to the extent necessary with species, *e.g.*, spruce, whose lower branches must be killed when very young if the stems are to clean themselves properly. For general purposes, and assuming the trees set out in triangles, a distance of 4 ft. from plant to plant may be taken as the standard, which means, theoretically, 3,144 trees per acre. An additional foot of interspace reduces the number of trees to 2,012 per acre, and such wide planting is quite justifiable in the case of good ground and a quick-growing species, where small thinnings are of low value.

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[1] *Journ. Board of Agr.*, Vol. xii., p. 722.

In the past the great majority of woods have suffered from over-thinning, nor has it been sufficiently recognised that a degree of density right for one species may be wrong for another. The main results of over-thinning are (1) the growing stock is not at its maximum, and consequently the highest annual increment cannot be secured, and (2) the trees are encouraged to retain their branches, and this means shorter boles and coarser and more knotty timber. Attention has, in many cases, been given too much to the individual trees, forgetting that in commercial forestry it is the yield of the wood as a whole, not the vigour of the single trees, that determines success.

Where woods are primarily designed as shelter-belts a degree of thinning that would be excessive under other circumstances is not only justifiable but necessary. Here the intention is to provide shelter to fields lying to leeward, and this object will be better secured by trees with low-reaching branches than by clean stems with small crowns confined to the upper third or fourth of their length. Moreover, such trees, being better balanced and better rooted, are not so liable to be blown down or broken over, and a shelter-belt, as its name implies, is generally formed in an exposed situation where stability is vital to success. Similarly along the windward side of a wood, thinning should begin earlier and be carried further. On that side of the wood, too, deep-rooted species and those which, given space, will produce and retain strong side branches should be employed. Such trees are the beech, oak, silver fir and Corsican and black Austrian pines. It is perhaps not generally recognised that the safety of a wood in regard to gales is largely dependent on the outer fringe of trees, and especially on the outermost row. The marginal trees should be encouraged to produce strong low-reaching branches on the windward side, for it is evident that these provide the best counterpoise to the pressure of the wind, and as long as they remain standing the rest of the wood is fairly secure. And yet one sometimes sees such marginal trees severely pruned in an attempt to produce "clean" boles, the fact being overlooked that it is their very roughness which gives them their special value.

Replanting with conifers a cleared area of this class of tree is often disappointing on account of damage by insects, especially the Pine Weevil (*Hylobius abietis*). This beetle breeds abundantly in the stools of recently felled pines, and in stems and strong branches that may be left for a year or two on or near the denuded area. From these breeding places it emerges to feed upon the bark of young conifers, and in the case of a severe infestation hardly a plant will escape. Much can be done to combat it by stripping the bark from the stools and exposed roots, and by timely removal or destruction of all top and lop. The insect may also be trapped by laying out inverted pieces of fresh coniferous bark, at least a foot square, from which the insects are collected and placed in wide-mouthed bottles, to be afterwards destroyed. When the weevils are most abundant, usually in May and the first half of June, the traps must be visited daily. Thereafter, inspection every two or three days will suffice. The attractiveness of the lures is improved by placing some fresh sawdust underneath, and both the slabs and the sawdust should be renewed every fortnight or so. Twenty such traps per acre will account for large numbers of weevils. But concurrently with trapping the insects should be hand-picked from the stems and herbage, an eradicative method more effective even than trapping. A few pine stems left lying in a wood will also attract the insect for breeding purposes, and when the eggs have been laid, but before the weevils have emerged, these stems may be removed and sawn up for firewood or, if large enough, used for other purposes.

Until comparatively recently almost the only method of combating the pine weevil was to defer replanting for five or six years after a wood had been felled, during which time the old stools passed into a condition unsuitable for the breeding of the insect. But when the loss of growth during this period is considered, and also in view of the fact that rank weeds will have established themselves on the area, considerable expenditure on trapping and hand-picking, by making immediate re-stocking possible, is thoroughly justified.

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THE CORN AND MEAT TRADES DURING THE WAR. III.

[NOTE —Permission to publish details of corn and meat imports during 1917 has been refused, and in consequence it is not possible to continue the review of the meat trade given last year, whilst the review of the corn trade is much curtailed.—ED]

THE CORN TRADE.

THE true measure of State intervention will be more fittingly found in reference to tables and particulars prepared with other objects than those of the State. Thus our annual returns recording Corn Trade tables compiled with an eye to that which concerns agriculturists in this country may be regarded as affording a fair index to the degree to which Government Departments in 1917 have interfered with the ordinary channels of information. Out of 19 tables, 12 have been entirely suppressed, one is cut down, six remain. Comment were unnecessary, it must be replaced by a hope that the advantages to be revealed on such inquiry as must follow the war, will prove to have been commensurate with the obvious drawbacks of what amounts to a suppression of two-thirds of the information by the light of which the Corn Trade is ordinarily conducted.

TABLE I.

Returns of wheat and flour imports for the shipping year ended July. 31, 1917, are suppressed, but the following past returns are available.

August 1—*December* 31, 1916.

EMPIRE:		
Canada	2,659,000	quarters (480 lb)
India	1,245,000	
Australia	426,000	
ABROAD·		
Argentina	316,000	
U S.A	5,232,000	
Unclassified	17,000	
TOTAL	9,895,000	

In January, 1917, imports of breadstuffs were 1,698,000 qrs. but it is illegal to name sources of supply. Six months' aggregate imports were 11,596,000, being at the rate of 23,192,000 qrs. per annum. The imports for the complete shipping year ended August 31, 1916, were 27,018,000 qrs.

TABLES II., III., IV., V., VI., and XII.

These Tables in their proper form as given last year are suppressed.

The imports of oats in the second half of the cereal year are known to have been increased, whereas the failure to maintain a supply of maize was the cause of great difficulty with respect to the feeding of horses and poultry; neither was it wholly without effect on the supply of feed for live stock.

As regards barley it was evident that North America alone was likely to be a prominent source of supply in 1917, and the experience of the trade during the year was entirely to that effect. The Australian malting barley, which used to be a good deal appreciated by our brewers, has vanished entirely from the market, and India's material surplus has been hung up for want of tonnage.

The South American oats shipped included a useful percentage of Chilian both of tawny and of white types. These oats weigh 320 lb., and find a very ready sale on British markets.

TABLE VI.

Maize shipments are not officially ascertainable, but there were no imports in October, November and December, 1917, and the situation has been admittedly grave ever since Michaelmas. A bumper crop in the U.S.A. in October is now being shipped, and should make a great difference to 1918 trade. The very natural impatience of the trade for November and December shipments needs no comment, but the maize heads or cobs take two months to dry, and the American Government does not allow exports in unfit condition. Figures for the half-year may be worth giving as a record, but those for the second half of the shipping period when released after the war will show greatly reduced totals.

Maize Shipments to Europe (480 *lb.*).

		North America	South America	South Africa
August . . .	1916	626,000	1,449,000	250,000
September . .	„	647,000	1,690,000	
October . .	„	485,000	1,902,000	
November . .	„	295,000	1,630,000	
December . .	„	166,000	1,154,000	
January . . .	1917	280,000	1,149,000	
Half-year		2,549,000	8,974,000	250,000
Rate per annum . .		5,094,000	17,948,000	500,000
Previous full year .		5,215,000	18,400,000	Unimportant

Although the South African figures are an estimate for six months only, it is fairly safe to give them as indicative of a rising trade which after the war may become of material importance, the more so as South Africa can grow the small maize particularly favoured by poultry and pigeon keepers, an interest which, severely discouraged as it has been by the Executive, is not likely to go under without a struggle. Maize is peculiarly adapted for use as poultry food, while its more direct employment for human consumption is open to a good deal of question, though the South African shipments have been of very high quality. The year 1917 passed without the receipt of any maize from the Mediterranean countries. As Spain, the South of France, North Africa and Egypt usually send some small, round maize, this loss has been felt. The production of maize on the Mediterranean littoral had been expected to be increased by the withdrawal of Russian and Roumanian competition.

TABLE VII.—*Prices of Imported Produce, August 1—July 31 (Shipping Years).*

First market of month. 1. Best Canadian Wheat, per 480 lb. 2. Argentine Wheat, per 480 lb. 3. American Red Winter Wheat, per 100 lb. 4. Foreign Feeding Barley, per 400 lb. 5. Foreign Light Oats, per 304 lb. 6. Maize, per 480 lb. 7. Linseed, per 416 lb. 8. Feeding Rice, cleaned, per 112 lb. 9. Fine American Flour, per 280 lb. 10. Feeding Sugar, per 112 lb.

	1	2	3	4	5	6	7	8	9	10
I. SHIPPING YEAR 1914-15										
1914										
August .	45/-	42/-	9/-	27/-	21/-	31/-	54/-	9/-	31/-	10/-
September	50/-	—	9/1	30/-	29/-	33/-	54/-	12/-	39/-	20/-
October .	47/9	—	8/8	27/-	27/-	27/-	48/-	12/-	37/-	20/-
November.	49/6	—	9/-	29/-	29/-	31/-	45/-	11/9	38/6	18/-
December	50/-	—	9/5	30/-	28/-	29/-	46/-	11/9	38/-	15/-
1915										
January .	54/-	52/-	10/4	30/-	29/-	29/-	46/-	12/-	40/-	15/-
February .	68/-	68/-	13/6	37/-	34/-	37/-	56/-	12/-	49/-	15/-
March .	67/-	67/-	13/8	36/-	32/-	38/-	52/-	11/-	49/-	17/-
April .	68/-	65/-	13/2	35/-	31/-	35/-	50/-	12/-	48/-	16/-
May . .	71/-	67/-	14/-	35/-	31/-	40/-	52/-	11/9	50/-	19/-
June. .	70/-	68/-	13/6	35/-	29/-	36/-	55/-	11/9	50/-	20/-
July . .	58/-	53/-	11/9	36/-	27/-	32/-	54/-	12/-	46/-	20/-
II. SHIPPING YEAR 1915-16.										
August .	60/-	57/-	11/6	39/-	27/-	32/-	54/-	12/-	45/-	20/-
September	60/-	56/-	11/4	41/-	26/-	32/-	55/-	13/-	43/-	22/-
October .	62/-	56/-	10/3	37/-	27/-	32/-	54/-	14/-	42/-	25/-
November.	60/-	58/-	11/2	40/-	32/-	38/-	59/-	14/-	43/-	29/-
December	61/-	59/-	11/8	39/-	31/-	41/-	65/-	14/6	45/-	30/-

II.—SHIPPING YEAR, 1915-16—*continued.*

1916										
January .	67/-	63/-	12/8	41/-	33/-	47/-	75/-	15/6	48/-	31/-
February .	72/-	66/-	15/-	44/-	33/-	50/-	80/-	16/-	51/-	31/-
March .	72/-	70/-	15/-	46/-	32/-	53/-	78/-	16/6	50/-	30/-
April. .	66/-	64/-	13/-	43/-	28/-	46/-	75/-	16/-	47/-	30/-
May . .	63/-	62/-	12/-	45/-	35/-	53/-	71/-	15/6	48/-	30/-
June. .	56/-	57/-	10/-	41/-	30/-	44/-	69/-	17/-	43/-	30/-
July . .	52/-	52/-	9/9	41/-	30/-	44/-	69/-	17/-	43/-	30/-

III. SHIPPING YEAR 1916-17

August	67/-	65/-	12/-	44/-	32/-	52/-	74/-	16/9	46/-	31/-
September	73/-	70/-	12/6	46/-	32/-	52/-	76/-	17/-	53/-	31/-
October .	76/-	72/-	12/9	46/-	35/-	51/-	81/-	17/3	53/-	31/-
November.	87/-	81/-	13/6	48/-	38/-	56/-	88/-	17/3	55/-	31/-
December.	87/-	81/-	13/9	64/-	45/-	65/-	105/-	18/-	62/-	31/-
1917										
January .	92/-	86/-	15/9	65/-	49/-	67/-	110/-	19/-	62/-	31/-
February .	82/-	78/-	15/6	65/-	53/-	70/-	110/-	26/-	66/-	34/-
March	84/-	80/-	16/-	66/-	54/-	71/-	112/-	26/-	67/-	34/-
April .	83/-	79/-	15/9	68/-	66/-	73/-	118/-	26/-	72/-	34/-
May . .	83/-	80/-	16/-	68/-	68/-	76/-	120/-	26/-	75/-	34/-
June. .	84/-	81/-	16/3	68/-	68/-	73/-	120/-	26/-	80/-	34/-
July . .	84/-	81/-	16/3	66/-	65/-	73/-	120/-	26/-	81/-	34/-

The history of the market is in reality comprised under one heading, that of a steadily advancing exchange taken early or late under Government control. The successes and failures of the Executive cease from the inauguration of fixed prices to be registered thereby, and the public can only judge by the abundance or scarcity of the articles tendered. The supply of maize lasted for the shipping year but gave out in September.

TABLE VIII.

Prices for the cereal year, according to the official weekly returns of the Board of Agriculture, are as follows; this year runs from September 1 to August 31, that of the shipping world from August 1 to July 31:—

Harvest years	Prices per quarter					
Sept. 1—August 31	Wheat		Barley		Oats	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
1905—1906 Board of Agriculture Journal	28	9	24	2	18	5
1906—1907 " " "	28	1	24	5	18	4
1907—1908 " " "	32	9	25	8	18	2
1908—1909 " " "	36	6	26	11	18	10
1909—1910 " " "	32	6	23	10	17	8
1910—1911 " " "	30	11	24	9	17	8
1911—1912 " " "	34	10	31	2	21	6
1912—1913 " " "	32	0	27	10	19	7
1913—1914 " " "	32	4	26	10	19	1
1914—1915 " " "	49	9	32	6	28	8
1915—1916 " " "	53	0	49	0	30	11
1916—1917 Mark Lane Express . .	74	4	65	0	47	3

TABLE IX.—*British Prices. First Market of each month.*

	Wheat, 480 lb. Average	Barley, 400 lb. Average	Oats, 312 lb. Average	Household flour, 280 lb. No. 1	Bread, 4 lb. household
1914.					
August . . .	34/2	25/9	19/8	32/-	5*d.*
September . .	36/5	30/6	23/9	34/-	5½*d.*
October . . .	37/1	29/1	22/9	34/9	6*d.*
November . .	38/8	28/6	23/7	36/-	6½*d*
December . .	42/2	30/2	25/9	39/6	7*d.*
1915.					
January . . .	44/4	29/10	26/6	46/6	8*d.*
February . . .	53/3	32/5	29/10	49/3	8½*d.*
March . . .	55/11	34/6	31/8	51/-	9*d.*
April . . .	54/6	31/9	30/6	52/-	9*d.*
May . . .	58/3	32/7	31/5	53/-	9*d.*
June . . .	61/9	35/4	32/5	47/-	[illegible]*d.*
July . . .	49/5	35/3	31/1	43/-	8*d.*
August . . .	55/4	35/7	31/5	44/-	8*d.*
September . .	45/3	38/1	26/10	42/-	8*d.*
October .	43/5	40/4	26/5	43/6	8*d.*
November .	51/6	47/3	30/4	44/-	8*d.*
December . .	53/7	49/-	31/-	46/-	8½*d.*
1916.					
January . . .	54/9	47/5	30/10	49/-	9*d.*
February .	58/3	52/5	32/4	52/-	9½*d.*
March . .	59/4	55/7	32/4	52/-	9½*d.*
April . .	53/6	53/8	30/5	48/-	9*d.*
May . .	55/7	53/1	32/10	48/-	9*d*
June .	53/3	53/9	33/3	46/-	8½*d.*
July .	46/3	40/1	30/10	41/-	8*d.*
August . .	55/1	46/1	32/9	47/-	8½*d.*
September	59/4	48/5	30/5	54/-	9½*d.*
October .	59/2	54/5	31/1	56/-	9½*d.*
November .	66/7	56/2	34/-	60/-	10*d.*
December .	71/3	63/1	41/4	59/-	10*d.*
1917.					
January . . .	76/-	66/-	47/3	59/-	10*d*
February . . .	76/6	64/-	47/3	60/-	10½*d*
March .	77/4	64/-	48/-	60/-	10½*d.*
April . . .	84/4	71/10	57/2	62/-	11½*d.*
May . . .	77/7	64/4	55/2	62/-	12*d.*
June .	78/-	68/-	54/9	62/-	12*d.*
July . . .	78/3	72/-	55/2	60/-	12*d.*
August . . .	78/2	72/-	55/2	60/-	12*d.*
September .	72/1	60/4	46/7	44/3[1]	9*d.*[1]
October . . .	70/6	58/5	44/7	44/3[1]	9*d.*[1]
November . .	70/4	60/1	43/-	44/3[1]	9*d.*[1]
December . .	70/2	59/3	44/3	44/3[1]	9*d.*[1]

[1] Supply by the State-at fixed prices (much below cost).

Criticism of figures for 1917 would be criticism of Government control, and as such beyond our scope. In April the price of English wheat of the 1916 crop was controlled, in September that of the 1917 crop. Similar controls were extended, and at the same dates our barley and oats of home production. At the end of the old cereal year (August 31, 1917), a Government decision of an extremely significant character was arrived at. It must suffice to note that from September 1, 1917, flour and bread ceased to be sold at cost price. The Government assumed entire control of the mills, and sold flour therefrom at 44*s*. 3*d*., or 15*s*. 9*d*. decline on the last free quotation. Bakers were compelled by decree to sell bread at ninepence instead of a shilling, but the price at which they obtain the flour leaves them a comfortable profit, and the national taxation has to bear the burden in the form of supplying bakers with flour at not less than 15*s*. 9*d*. per sack under its last known cost price. As on January 1 the Government raised the price of wheat cargoes 2*s*. per quarter, it is currently presumed that it has been losing money on imported wheat at a rate equalling about 18*s*. per sack (280 lb.) of flour. This, too, was the duty levied on exportation up to the close of 1917. The present charges are in some cases higher, and since March 25, 1918, 36*s*. has been charged on the use of flour for biscuits, including dog biscuits.

The advance in the price of barley from 25*s*. 9*d*., its lowest (August, 1914), to 71*s*. 10*d*., its highest (April, 1917), was 46*s*. 1*d*.; but the quotation with which 1917 closed was 12*s*. 7*d*. below the maximum, and makes the position materially easier both for maltsters and for millers, the latter having been very extensive users of barley as an addition to the loaf. The agricultural disadvantage in the situation is in the encouragement of growing a coarse type of barley for quantity rather than a fine type of somewhat less fecundity, for quality. In peace years England can only compete with foreign barley growers by producing a quality article. Oats, after advancing from 19*s*. 8*d*. (August, 1914) to 57*s*. 2*d*. (April, 1917), receded by the end of 1917 to 44*s*. 3*d*. The extension of the area under oats is a very good sign, and at 44*s*. 3*d*. there is still a good margin for profit on land which bears only a pastoral rent. The price, however, will not adequately remunerate cultivation of the better soils, and on January, 1918, Chilian oats, of about the same grade as English, were fetching 71*s*. per quarter. The farmer was therefore contributing 26*s*. 9*d*. per quarter to the national benefit as the result of acceding to a maximum on home produce as compared with a free market accorded to his rivals. The free market still allowed for home-grown pulse, carried both beans and peas to 120*s*. per 504 lb. before 1917 closed, and still more remarkable prices have been registered since 1918 was with us.

TABLE X.—*Breadstuffs. Supplies for the Harvest Years, September* 1—*August* 31.

Unit 1,000 quarters

	1916-17	1915-16	1914-15	1913-14	1912-13
	Qrs (480 lb)	Qrs. (480 lb)	Qrs (480 lb)	Qrs (480 lb)	Qrs (480 lb)
British	5,526	7,324	7,804	7,087	7,175
Imported .		26,591	26,013	26,921	30,149
Total .		33,915	33,817	34,008	37,324
Wants	23,924	34,000	33,600	33,200	32,800
Increase of reserves		—	217	808	4 524
Decrease "		85		—	–

The United Kingdom entered on the war with good reserves of breadstuffs. Imports had greatly exceeded the average in 1912-13, and the home crops had been fair. The prices only had not tempted holders to sell If during the first two years of the war an economical disposition had been manifested the situation on September 1, 1917, would have been comparatively easy. But no such disposition was manifested, and the Government has had to choose between two policies, the first of rationing the bread-eater, the second of lowering the standard of the bread. The second has been the policy adopted. The mills have been commandeered, as there was a danger of the miller persisting in making good bread. The State-owned mills have been "loyal" enough; no consumer of bread doubts the operatives' obedience. The incorporation of 13 per cent. of middlings is manifest to the eye as well as to the palate. The saving of wheat has been further increased by the addition of 20 per cent. of a cereal other than wheat. This mixture, where barley or oats have been added, has been a success; it has been a failure where maize or beans have constituted the addition. These staples are eminently usable as separate preparations for the table, but beans, such as haricot and Madagascar, require much butter in their presentation, and the scarcity of that article has affected the use of the beans. Reckoning the increase of population, the natural needs of the United Kingdom for 1916-17 would have been 34,400,000 quarters. The population increase often is, but never should be, ignored. Taking, therefore, needs at 34,400,000 quarters, but declining Lord Rhondda's invitation to allow extra consumption by the army to be likely, we get at 23,942,400 quarters as the actual probable consumption of wheat after adding 13 per cent. of middlings and 20 per cent. of non-wheat farinaceous food. The decision of the Government not to state the imports prevents our ascertaining how we really fared for the cereal year; but Mr. Lloyd George stated on August 16, 1917, that stocks had increased by two millions, and as this would only require 20,398,000 quarters to have been imported as compared with 26,591,000 quarters in 1915-16, a war year, the reader may infer without much fear of exaggeration that over 20,000,000 quarters were actually landed on our shores.

TABLE XI.—*Feeding Stuffs Imports. Harvest Years, September* 1—*August* 31.

Unit 1,000 quarters

	1916 17	1915-16	1914-15	1913 14	1912 13
	Qrs	Qrs	Qrs	Qrs	Qrs
Maize (480 lb)		8,497	11,197	9,375	11,557
Barley (400 lb)		4 764	3,512	5 928	6,259
Oats (304 lb)		4 814	5,654	5,665	7,373

The receipts from abroad up to the decree making it penal to publish figures were:—

Unit 1,000 qrs		Maize (480 lb)	Barley (400 lb)	Oats (304 lb)
September	. 1916	1,025	532	620
October	"	858	416	271
November	. "	823	168	156
December	"	924	221	56
January	1917	527	192	89
Five months	.	4,157	1,529	1,194
Rate for 12 months	.	9,976	3,669	2,865

Taken as a general index these figures will probably afford a reasonable clue to importations of feeding stuffs as a whole, but the evidence of the Government's own tenders of grain to buyers lead us to suppose that the imports of maize have been short of what is above indicated, the deficiency being made up in the form of light American and Canadian oats. The imports of barley have been fair of North American, but the failure to ship the Indian surplus has certainly reduced the total supply into this country very considerably.

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MEDICINAL HERBS.

In Tudor times England was the head distributing centre of the medicinal herb commerce of Europe, but like so many of our trades it has been allowed gradually to decay and pass into the hands of foreign nations who have not been slow in securing it for themselves; this is especially true of Germany, Austria-Hungary, Turkey and the Balkan States. Germany has provided her peasant children with instruction in her schools so that they know by name and sight the principal medical herbs. Inspectors and collectors are provided by the Government for the marketing, and the cheap labour of women and children provides the material for the greater part of the trade. With us, prosperity, unrestricted importation and the apathy and ignorance of the public in the matter of this important branch of national commerce have all contributed to oust the native products from our market and give the foreigner every advantage, and it is only since the present war closed the door on the enemy producer that we have had the unpleasant truth forced upon us that our home trade was quite unable to provide us with the required medical herbal extracts necessary for normal wants, much less for the increased and ever increasing demands of the war.

The British firms welcome and indeed prefer the native herbs as being fresher and more reliable than the imported. Adulteration has been practised by the Central Empires even up to 70 per cent. in one very important herb. If we should give away this trade by unrestricted importation, we must face a new danger, for Germany will not send us her best herbs, which, indeed, she has never done, but will flood our market with "substitutes," the surplus of her war manufactures, in which she has certainly proved herself an expert.

So far no Government has given any help or leading in this important matter; no standard of purity has been strictly enforced, and our merchants have been compelled to accept what was offered, as there was little home competitive trade to rely on, and it has been left to individual efforts to increase the native production.

As regards cultivated herbs, many of the large chemist firms in England have their farms on which are grown the herbs needed for their own supply; there are as well many old established farms which cultivate only a few varieties, such as lavender and peppermint, two native productions that have long been pre-eminent in every market, and which are grown for their essential oils. Other farms grow many kinds of herbs according to the demand. For all herbs used in patent medicines there is a steady contract trade.

The principal medicinal herbs may be divided roughly into four classes :—

1st.—The more highly priced herbs, which pay for special treatment, and are principally grown on herb farms.

2nd.—The commoner garden herbs that only require cottage garden or allotment culture.

3rd.—The wild medicinal herbs (many called weeds) that are widely spread over our native land and only require collecting and drying.

4th.—A few special herbs that cannot be grown in Britain to any appreciable extent owing to their requiring different climatic conditions and soils ; these our colonies would supply, but it is not necessary to speak of them here, as this article only treats of what constitutes the native medical herb trade.

CLASS I.

The principal plants in this division are poisonous. Careful cultivation produces the best results, and some attention should be paid to the breeding of the herb, by gathering seeds or taking cuttings from those plants that have done well in the past season. In every class there are varieties more or less valuable according to their alkaloid products. The herbs that stand first in this class are Deadly Nightshade (*Atropa Belladonna*), Monkshood (*Aconitum napellus*), Henbane (*Hyoscyamus*), Thorn Apple (*Datura Stramonium*). All these are found wild, but for trade purposes they are more profitable if carefully cultivated, as in their wild state they cannot be depended on for quantity or quality, being subject to disease and many insect enemies.

Deadly Nightshade (Atropa Belladonna) is a perennial from three to four feet high, large ovate leaves, drooping bell-shaped purple flowers, fruit a black glossy berry, very poisonous, but the plant is cut before it fruits ; the leaves appear in March. Flowers from June to August. From the beginning of May onward the leaves can be gathered for drying from mature plants only—the flowering tops also, but separately. In common with all medicinal herbs, it is important that no part of the plant should be gathered when wet. Belladonna plants raised from seed under glass and planted out when all danger of frost is over, should not have the leaves picked the first year, but only have the tops pinched off, the leaves can be taken the second year until the fourth, when the roots should be dug in the autumn, washed and sliced for drying.

Monkshood (Aconitum napellus).—A perennial from one to three feet high, very poisonous, leaves dark green deeply cut, flowers shaped like a helmet, forming a handsome spike, the dark blue being the only variety used in medicine. The root is the part wanted. In the autumn the roots should be carefully taken up, the smaller ones replanted, and the larger washed and dried for marketing.

Henbane (Hyoscyamus niger) is from two to three feet high, leaves large and hairy, flowers cream colour with purple veins and dark centre. Flowers in June and July. An evil smelling herb and a narcotic poison. The whole plant is wanted, dried as recommended for Datura.

Thorn Apple (Datura Stramonium) is an annual, coarser than Belladonna, from one to two feet high, the leaves are large lobed, flowers white with a yellow tinge, fruit a large thorny capsule. The plant has a very offensive smell when broken or bruised. Flowers in June and July. The whole plant is used medicinally, and is best dried in bunches hung over a string or wire, the leaves and the flowering stems being dried separately.

CLASS II.

This is a very comprehensive class, including most of what are called pot-herbs. Peppermint (*Mentha piperita*) and Mint (*Mentha viridis*), known in the trade as Spearmint, is the usual lamb sauce mint. These are the only two mints that are used to any extent in medicine.

Balm, Horehound (the white variety only), Tansy, Pennyroyal, Rue, Wormwood, Marjoram (garden and wild), Sage (green and red), Thyme, Lavender Flowers, Rosemary Leaves and Flowers, Double-flowered Chamomile, Raspberry Leaves (garden and wild), Fennel, Opium Poppy, Marigold, Dark-coloured Rose Petals, all of these have a market value.

Peppermint (Mentha piperita), a perennial, with creeping roots; leaves rather darker than the common mint. The flowers are a dull mauve, growing at the leaf stalks, continuing to the end of the flowering spike. The peculiar odour of the plant cannot be mistaken. Flowers the end of summer: plant wanted, cut to within a few inches of the ground; best dried in bunches, away from other herbs.

Mint (Mentha viridis), Spearmint, a perennial, the leaves greener and narrower than peppermint, and the spike more tapering; flowers mauve. The whole plant wanted, cut a few inches from the ground. Best dried as for peppermint, or leaves only can be dried separately (this ensures a better price). Flowers end of summer.

Balm (Melissa officinalis), a well known cottage garden herb, coarse, toothed, green leaves (the variegated kind is not wanted). The flowering stems should be cut off a few inches from the ground, and dried in bunches. Flowers in late summer.

White Horehound (Marrubium vulgare).—A white, woolly plant, about 18 inches high; leaves much wrinkled. Flowers dirty white, in thick clusters at the leaf stalks. This may be found wild occasionally, but is much improved by garden cultivation. Flowers in the summer and autumn. Best dried in bunches. The black horehound (Ballota) has no medical value.

Tansy (Tanacetum vulgare), a thick stemmed perennial, two to three feet high, large, deeply cut leaves; flowers deep yellow, in large heads. The whole plant has a strong scent, and very bitter taste. Flowers early in autumn. The plant is wanted, cut above the woody stalks. Best dried in bunches.

Pennyroyal (Mentha pulegium), a low growing perennial, with small leaves, small flowers thickly clustered round the leaf stalks. Flowers in autumn. Plant wanted. Best dried in bunches.

Rue (Ruta graveolens), a small bushy perennial, with bluish green leaves, finely cut; flowers yellow. The plant is wanted. Best dried in bunches, without the woody stems. Flowers in the autumn.

Wormwood (Artemisia Absinthium), a branched leafy plant, leaves bluntly cut. The whole plant is greyish green, with a bitter taste; flowers dull yellow. Leaves and small twigs wanted. Can be dried in bunches, or on shelves. Flowers late summer.

Marjoram (Origanum) Sweet Marjoram.—Herb growing about two feet high, with egg-shaped leaves, and heads of purplish flowers. The whole plant is wanted, except the thick woody stems. Easily dried in bunches. Flowers in July and August. The wild Marjoram is also wanted; same treatment.

Sage (Salvia officinalis).—This herb is well known in all cottage and kitchen gardens. It is wanted just before it flowers in the summer. Dried in bunches, without the woody stems. The red variety is also wanted.

Thyme (Thymus vulgaris) and Lemon Thyme.—This is wanted, and is easy to dry. It should be gathered when just in flower in the summer.

Wild Thyme (Thymus serpyllum).—This is also wanted; same treatment.

Chamomile, double flowered, (Authemis nobilis).—This herb is rather difficult to describe, as there are many similar plants. The leaves are finely cut, but not so fennel-like as the Matricaria plants, which the flower resembles, both having white petals. This chamomile has a pleasant smell, but is very bitter to the taste. The plant is wanted, and is best dried in bunches quickly. Flowers in July and August.

Fennel (Fœniculum vulgare), a well-known herb, the stem often three feet high; leaves finely cut, hair-like and soft. Flowers in flat head, small greenish yellow. The seeds dried are the parts wanted. Flowers in July and autumn.

Marigold (Calendula), an annual. The petals only are wanted, the deep orange kind. These should be picked off and put on a piece of cardboard, a box lid will do, and dried quickly in a moderate oven, shaking them occasionally to prevent them sticking together.

Poppy (Papaver somniferum).—The large leaves are bluish green, slightly toothed, grow about two feet high. Flowers white, with a purple patch at the base of petals. The dried mature heads are wanted. Cut before the seeds fall, and marketed in boxes or closely woven sacks.[1]

Violet Flowers.—The purple, sweet-scented kind. For these there is only a limited market, and many buyers prefer them sent fresh instead of dried.

Lavender flowers (Lavandula).—This is too well known to need description. The *flowers* only are wanted. It should be ascertained whether they are wanted dried or fresh.

Rosemary (Rosemarinis).—This is also well known in cottage gardens. The leaves (not stems) and flowers wanted. Inquiry same as for Lavender.

Rose Petals, dark coloured. Same treatment as for Marigolds.

Raspberry Leaves, garden and wild. Leaves and leaf-stalks only, not the woody stems. In gathering the wild variety it should be remembered that the underside of the leaf is white.

CLASS III.

This comprises the wild herbs, of which there is an almost endless list, but space will not permit the mention of any beyond those which can be easily found and for which there is a steady market demand. The first to appear, generally about the middle of February and onwards, is the *Lesser Celandine* (Ranunculus Ficaria); leaves and flowers dried together are wanted, no roots. This glossy-leaved, golden-flowered weed is found everywhere, under hedges, in gardens and by every road-side, its season is short as the flowers fade quickly. Extra tuberous rootlets form on the creeping stems, and these should not be dried, but removing them adds much to the work. Can be dried in bunches across strings or wire, or thinly spread on canvas-covered shelves. Flowers early in March.

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[1] For the cultivation of this plant see Stephenson, Journal R.A.S.E., Vol. 75, p. 83.

Couch Grass (Triticum repens).—Dug up in the months of March and April, washed, dried and cut into 4-inch lengths; this is only profitable when a good quantity can be harvested. In Italy it is dried, washed, tied in bunches and fed to horses as the first fresh forage, and is said to be very nutritious.

Ground Ivy (Nepeta Glechoma).—This is not an Ivy. A creeping weed with rising flower stems and violet blue flowers growing at the leaf stalks, leaves green, round and slightly toothed, one variety has bronze-tinged leaves. The plant is wanted, but no roots. It flowers from April onward. Is best dried hung in small bunches.

Wood Sorrel (Oxalis Acetosella).—A delicate clover-like spring plant, found in woods and shady places. White flowers on single stalks, flowers in early spring. Leaves and flowers only wanted. Can be dried on canvas-covered shelves.

Coltsfoot (Tussilago).—This broad-leaved weed, shaped like its name, is found on clay soil in waste places and in fields. The leaves only are wanted. They are white underneath and covered with a cottony down, not to be disturbed. They should be dried flat on wire netting or canvas-covered shelves and turned frequently. The leaves grow in the spring.

Shining Cranesbill (Geranium Lucidum).—A beautiful little weed, low growing, leaves nearly round, and glossy, stems and stalks generally red, star-like rose coloured flowers, grows by and on old walls and stony places. Flowers spring and summer. Whole plant is wanted. Best dried in bunches over a wire or string.

Bugle (Ajuga reptans).—A low-growing plant with purple blue flowers on a leafy spike, found near hedges and in damp meadows, flowers in spring and early summer. The plant is wanted when in flower and should be dried in bunches.

Self heal (Prunella).—A creeping hairy plant like a smaller, coarser Bugle, short spikes of flowers, violet with brownish leaves. Grows in fields and on banks. Same treatment as for Bugle. Flowers all the summer.

Wood Betony (Stachys Betonica).—A pretty soft hairy plant, with a head of light purple flowers which have always two small longish leaves growing just under the flower head. Found in fields, woods and hedges. The plant wanted when in flower. Dried in bunches or on shelves. Flowers June, July and August.

Agrimony (Agrimonia eupatoria).—A slender hairy plant, with cut leaves, yellow flowers on a long spike. Grows in meadows under hedges. Flowers in June, July and August. Plant wanted when in flower. Dry in bunches.

Herb Robert (Geranium robertianum).—This is a well-known plant, with finely cut leaves, red hairy stems rather thick, reddish flowers like those of the Shining Cranesbill. Flowers all the summer. The whole plant is wanted, dried in bunches with good care owing to the thick stems.

Sanicle (Sanicula europa).—A glossy-leaved plant, with flowers dull white in small heads. Found in woods. Flowers in June and July. The whole plant wanted. Dried in bunches.

Cleavers or *Clivers* (Galium Aparine).—A well-known plant, hairy, almost prickly leaves and stems, trails over hedges and bushes; flowers very small and greenish white. Flowers all the summer. Wanted when in flower. Very easily dried; should be a good green colour, not brown.

Woodruff (Asperula odorata).—A smaller lower plant than Cleavers, small leaves growing round the stem, eight together. Flowers white, has a smell of hay when drying. The flowering stem with leaves and flowers wanted, easily dried. Flowers in early summer. There is a similar plant (Crosswort) of no medical value, which should not be taken for either Cleavers or Woodruff, but the flowers are yellow instead of white, and the leaves grow in fours.

Meadow Sweet (Spiræa Ulmaria), Queen of the Meadow.—This sweet-scented plant is met with on the banks of ditches and ponds, leaves coarsely divided, whitish underneath, flowers small, flowering all the summer. The flowers and leaves wanted, not the thick woody stems. To be dried in bunches, flowers to keep their colour.

Yellow Flowered Dead Nettle (Archangel).—A pretty plant a foot or eighteen inches high. Grows like the white dead nettle. The plant is cut about three inches from the ground. Dried in small bunches. Flowers from May onwards.

Scull-cap (Scutellaria).—A small straggling plant slightly downy, leaves toothed, flowers dingy blue in pairs up the stem. Found in damp stony places. There is a much smaller variety, with pale pink flowers, also used in medicine. Both flower in the summer. Plants wanted, not roots.

Field Gentian (Gentiana campestris).—An annual, about six inches high, well furnished with leaves and flowers. The latter have a blue fringe round the edge. Flowers in autumn in open pastures and on limestone downs. Whole plant wanted. Dried in bunches or on shelves.

Melilot (Melilotis officinalis).—A branched plant with light green leaves and small yellow flowers on long spikes. The plant is not unlike a miniature yellow broom. Whole plant wanted, except the roots. Easily dried in bunches. Flowers in the summer.

Wood Sage (Teucrium Scorodonia).—An erect plant found in woods, with wrinkled leaves like garden sage. Insignificant yellowish flowers on spikes. The whole plant is wanted, except roots. Dried in bunches. Flowers in summer and autumn.

Yarrow (Achillea Millefolium). — This slightly hairy feathery-leaved weed is found on waste ground, roadsides and at the edges of fields. The stems are thick and woolly about a foot high. The flowers grow in a crowded flat head, purple, white, or purplish white. Has a rather spicy smell when drying. To be dried in thin bunches. The whole plant wanted, except the woody stems. Flowers from June onwards.

Centaury (Erythræa Centaurium).—A pretty annual, with a head of red flowers. Grows about one and a half feet high on dry pastures. Flowers all the summer. Plant only wanted; easily dried in bunches.

Wild Carrot (Daucus Carota).—A plant with feathery leaves, carroty smell. Large flat bunches of small white flowers, one flower in the middle bunch often purple, red or a different colour. When fading the outer bunches of flowers close over the inner ones, giving the shape of a bird's nest. Flowers late summer. Plant only wanted; dries best in bunches.

Mountain Flax (Linum catharticum) or Purging Flax.—A tiny plant, erect growing, from two to six inches high, dark hair-like stems, branched. Very small white flowers. Found in dry fields, flowering June and July. Plant wanted, very easily dried.

Figwort (Scrophularia nodosa) Knotted Figwort. — A square-stemmed somewhat coarse plant, occasionally found three feet high, leaves heart-shaped with longish points. Flowers insignificant of a dingy purplish green. The root is white, shaped like a fig. This plant has a strong offensive smell. Often found near walls or stony places. Flowers June and July. Plant wanted, not root; best dried in bunches.

Water Figwort (Scrophularia aquatica).—Square stemmed. Leaves heart-shaped but blunt. Flowers like Knotted Figwort but more important. Grows at sides of streams and ditches. Flowers July and August. Plant wanted, dried in bunches.

Avens (Geum urbanum), Herb Bennet. — A branching plant, erect, one to two feet high. Large thin leaves, generally divided into three. Flowers yellow, very small. Found on banks, under hedges and at the side of woods. Flowers June, July and August. The plant wanted, can be dried in bunches or on canvas shelves.

Hemlock (Conium maculatum) is a very poisonous herb, and should be gathered by adults only, as it is easily mistaken for other Umbelliferae; it can be distinguished from them by its purple-spotted stalk. It has a disagreeable mousy smell, which becomes worse during drying. Found in damp situations, flowers in summer and autumn. Leaves and flowers to be dried separately.

Foxglove (Digitalis purpurea).—This is well known, but only the dark purple-flowered variety has any medical value; roots and lower leaves wanted. Flowers in the summer. The leaves should be dried separately, spread singly on canvas shelves.

Eyebright (Euphrasia alchemilla).—A very small herb, deeply cut leaves, flowers white with mauve stripes and yellow blotches, which are very distinctive. The whole tiny branched plant is wanted, and should be cut as early as possible, as it is subject to orange rust. Flowers all the summer. Found in dry gravelly places, and at the foot of banks.

Wild St. John's Wort (Hypericum perforatum).—A perennial one to one and a half feet high, oval leaves, marked with transparent dots and sometimes with a few black ones on the under side. Flowers yellow growing in a head. Found in woods, hedges and by roadsides. Plant wanted, dried in bunches. Flowers summer and autumn. The garden varieties of St. John's Wort are of no medical use.

Mousear Hawkweed (Hieracium pilosella).—A small plant, downy small leaves. Flowers on a single head, lemon coloured. Grows on banks, waysides and dry pastures. The plant wanted. Flowers all the summer.

Wild Purple Scabious (Scabiosa succissa).—Leaves generally oval, stems about eighteen inches high. Flowers deep purple blue. The plant wanted, dried in bunches or on shelves. Flowers in the summer and autumn.

Parsley Piert (Alchemilla arvensis).—A tiny annual, leaves divided, flowers small, grow in little heads. Flowers all the summer. Grows in fields and stony places on the top of walls. Whole plant wanted, when in flower.

Hemp Agrimony (Eupatorium Cannabium).—A coarse-leaved plant about four feet high, flowers dull magenta in flattish bunches. Flowers in summer and early autumn. The whole plant, no roots, wanted. Should be hung up to dry in a good current of air.

Wild Valerian (Valeriana officinalis).—All-heal, none of the garden varieties (Valeriana centranthus) wanted. A thick branchy plant two to four feet high, leaves much cut up. Flowers in a head, small, white or slightly pink. Grows in woods and damp situations. Flowers all summer. The root dried is the part wanted, best dug in the autumn.

Comfrey (Symphetum officinale).—This coarse herb is sometimes grown in cottage gardens. It is about three feet high. Broad leaves tapering into a long point, very rough and hairy. Flower stems end in small bunches of drooping flowers, dingy purple, pale yellow, or dirty white. The flower stems wanted and the leaves that spring from the roots. Found on banks of streams and in damp situations. Leaves and stems should be dried in small bunches. Care should be taken not to dry Comfrey near the Foxglove (Digitalis), which is a poison, for the leaves are very similar and might be mistaken.

Elder Flowers (Sambucus niger).—The common elder, growing in the hedges and in gardens. Flowers in the summer. The flowers only, no stalks, wanted. The best way to gather is to shake the flower bunches over a box or paper when the corolla, if ripe, will fall. To be dried in a slow oven immediately, or the colour (a delicate cream) will be lost; if allowed to turn brown they are unsaleable.

Crimson Clover Flowers (Trifolium incarnatum).—This slender, hairy, broad-leaved clover, grown extensively for cattle feeding, has oval, deep red flower heads. In flower in the summer. The heads, no leaves, should be gathered when dry, and hung up in small bunches. The colour should be preserved.

Blackberry Leaves.—The Blackberry is found on hedges, banks, and in woods. The leaves are green underneath. Leaves with leafstalks only are wanted, not stems. Easily dried on shelves. Can be gathered at any time before the frost discolours them.

Lime Tree (Tilia).—The flowers with the stalks and winglike bracts attached. To be dried quickly to retain the colour.

Ash Tree (Fraxinus excelsa) leaves are sometimes asked for, dried.

Yellow Broom (Cytisus scoparius).—The tops only.

The principal roots required are :—

Dandelion (Leontodon Taraxacum).—Very large roots. These are best sent away green to the Association drying sheds. (See p. 82). The small roots should be sent separately.

Burdock (Arctium Lappa).—This is a tall, large-leaved kind, with purple thistle-like flowers, very bristly. Roots to be dried.

Docks (Rumex) of both kinds, the broad-leaved and the smaller pale-leaved. The roots can be easily dried in a cool oven, with the door open, the two kinds separately.

Meadow Saffron (Colchicum autumnale).—This is poisonous in every part. The seeds and corms are in demand.

Sweet Flag (Acorus Calamus) is found beside streams, and can be recognised by a slight frilliness at the edge of the leaves. The root only is wanted.

There are other herbs of more or less value to herbalists, but those on the foregoing lists are all used in the manufacture of medicines, ointments, perfumes, &c., in England, and all have their prices, ranging from 1½*d.* per lb. to 2*s.* 6*d.* when dried. The larger the quantity the higher the price, as the herb merchants do not care to take small parcels except of the rarer herbs.

Nearly all herbs are best dried under cover to preserve the colour, a good and even colour being considered essential by the trade. Two methods of drying are practised, both good. One is by tying the herb in small bunches, and placing these across a cord or wire fixed from wall to wall of the room ; the other is by spreading the herbs very thinly on frames covered with coarse canvas or fine wire netting. Canvas is the better. This method necessitates daily turning over the herbs, and is not available for the thick-stemmed varieties like Comfrey, Henbane, Datura, or Belladonna, but it is the best way of drying where the leaf only is wanted, as with Coltsfoot, Digitalis, &c. The great danger to good drying is damp, for once the herb has deteriorated and become mouldy, no after effort can make it useful for medicine. No insect-bitten leaves or any that have lost colour should be allowed in the drying room.

As regards organisation for the collecting of herbs, the National Herb-growing Association has been formed from the Women's Herb and Garden Union. Offices, 15 and 16 Verulam Street, Gray's Inn Road, London ; Secretary, Mr. Alfred Wolfe.

Leaflets are issued, and the trading part of the Association receives dried herbs and herbs for drying from the members, and markets them, besides giving much valuable help. There are other Associations, but of these the writer has no personal knowledge ; but it may be said that in spite of all efforts made the home trade is still inadequate, and the supply uncertain, so that the merchants are handicapped in the production of the herbal extracts which are necessary to meet the great demands of the hospitals and the medical profession generally.

Many county centres have been formed, and more would be possible if the necessary organisation were forthcoming. The writer can only give the experience of work begun and continued in one small part of a county. In November, 1915, a committee was formed to organise the collection of herbs for the locality, with a subscription of 5*s.* each for initial expenses. Each member had a centre, a district mapped out near her home, and chose her own helpers and collectors, being individually responsible for them and the herbs they gathered and dried, or sent to the chief centre to be dried, there to be finally inspected, packed, and sent to market. In March, 1916, real work was begun, the Association was affiliated to the National Herb-growing Association in London. Books were studied, help was sought in every direction to identify the herbs required. Correspondence was entered into to find markets, and though many were the difficulties, and alas, many the mistakes, still the work progressed. The committee often met, and many pleasant rambles were arranged for the helpers. Finally, after nine months' work, cheered by the warm appreciation given by all the merchants who bought the herbs, the season was closed with a credit balance of 32*l.* odd, which was distributed by the centres to their collectors and helpers. Similar work was undertaken in 1917, and though the season was most unfavourable for the collecting and drying of herbs, the little association justified its existence by presenting a credit balance of 50*l.* odd clear profit, after a deduction of a rate of 1*d.* per lb. on the finished article brought by women, and ½*d.* on that brought by children.

The co-operative principle is the rule. Each collector sends his or her herbs to the centre on appointed days, and from each centre the collection is sent to the chief centre. The whole consignment is then sent by rail to the National Herb-growing Association for sale, or to the herb firms with whom contracts have been made, and who pay by cheque on delivery. It may be argued that this method is only applicable to small undertakings, but it could be carried out over larger areas, either by the centres taking larger districts and sending to the chief centre, or by dividing the area worked, and appointing a chief centre for each division.

The daily press has from time to time published articles on the herb trade, showing that a Golconda mine can be found in every garden, and a fortune in every forest path. But these entrancing theories do not stand the test of practice, they are lovely fairy tales. The herb trade, like all other trades, is subject to the many changes and chances imposed by the law of supply and demand, and a committee would be well advised to make a study of the ruling prices, and the quantities required of the various herbs and roots, before embarking on any extensive outlay in the way of buying machinery, or hiring premises in which to conduct their business. As before stated, the National Herb-growing Association will dry herbs sent to them by its members for a small percentage, and if the distance is too great, and the transport too uncertain for the fresh herbs to reach their drying sheds in good condition, the process of home drying is not very difficult. What is required is a ventilated room or loft, with a current of sun-warmed air.

There are good and useful leaflets issued gratis by the Board of Agriculture and Fisheries, but the greatest help the Board of Education could give our school children would be instruction on the lines of that given in Germany, where the herb industry is thoroughly organised and fostered by the Government. Co-operation, and a chief centre undertaking the final packing and distribution, can alone meet the difficulty at present, and to these may be added patience, that "grey angel of success," for success *can* be achieved in spite of the many pitfalls that lie in the way of a trade that is new to the workers, and carried on by people who have had little practical instruction in the work they have so readily undertaken.

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SOME MINOR FARM CROPS. V.

WOAD.

JULIUS CÆSAR'S statement that the Britons stained their bodies with woad, "quod caerulam efficit colorem," raises the question whether this plant was cultivated in this country at the time of the Roman invasion. If it was not it is difficult to see how a sufficient supply was obtainable, for it is generally admitted that the woad plant, *Isatis tinctoria*, is not a native. Further, if "caerulam" is correctly translated as "blue" we meet with the further difficulty that this colour can only be extracted from woad after a long and intricate series of processes which seem too complicated for a primitive people ever to have discovered. Other classic authors refer to green Britons, or again speak of their swarthy hue. These colour descriptions are interesting, for they make it almost certain that the plant used as the source of the pigment was woad, for blue, green, and black can be obtained from it. But if simplicity of obtaining the colour effect can be considered as a criterion of the shade actually used by the ancient Britons, then they were probably black, for one only has to rub the skin with the fresh leaves of woad to impart to it a lasting black colour.

Cæsar's reference to woad has led, perhaps not unnaturally, to the view that its cultivation has been carried on in this country from immemorial times. In fact woad growing and flint knapping are occasionally mentioned as the two industries which have survived in a more or less unaltered form from prehistoric times. It is difficult to accept this view, however, for woad is a biennial plant, and the cultivation of a crop which, when seed was required, occupied the land for two seasons could hardly have been carried on on a large scale in the days of open fields.

As a matter of fact there seems to be no real evidence that woad was cultivated to any extent in this country before the thirteenth century. Even then the manufactured article was imported from the Continent, first to London, and later to Norwich, where the trade was transferred owing to the grievous impositions of the dock authorities of those days. There is still in existence an agreement drawn up between the inhabitants of Norwich and the woad merchants of Amiens and Corby, dated 1286, which defines the duties payable on their granaries, casks and frails of woad.[1]

In those days woad was practically the only source of blue colours available to the dyers, and for all practical purposes it remained so until the route to India by way of the Cape was discovered, and the importation of indigo in large quantities became possible. Woad growing was consequently a profitable industry, but in Elizabethan times it felt the effects of the competition with indigo sufficiently to require protection. Probably indigo began to be the chief source of blue colours about this period, and woad instead of being used as a dye was then used as a mordant for fixing other dyes. But little is known definitely about the matter. Blith, in "The English Improver Improved," gives us the first detailed account of the cultivation and preparation of the crop for market. One of the "six newer peeces of improvement" deals with "the Planting Welde, Woad, and Madder, three rich commodities for Dyers." He opens his account of the crop as follows :—"Woad is also a great commodity, it layes the foundation for the solidity of very many colours more ; a woaded colour is free from stayning, and excellent for holding its colour ; almost any sad holding colour must be Woaded."[2] For this purpose woad proved exceptionally useful, and it was on this account that its cultivation continued until recent times. But the palmy days of woad growing seemed to be passing about the time of Blith's description of the crop. "When it is a quick commodity as now it is dull," may well point to the falling off of cultivation.

This, however, is speculation only. By the time when Arthur Young was making his tour of the Eastern counties the condition of woad growing was a very precarious one, and after that it appears to have steadily declined. In Calder's account of the crop, written in 1894, he mentions that the only place in England in which woad was still grown and handled on the old lines was at Parson's Drove, near Wisbech. Its cultivation was continued there until 1913, when the difficulties of disposing of the crop at a profit brought the industry to a standstill.[1]

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[1] Corder. Norfolk and Norwich Naturalists' Soc., Vol. V.

[2] W. Blith. "The English Improver Improved," 3rd ed., 1653, p. 227.

The soil most suitable for the cultivation of woad is a rich, well-drained loam. Ordinary arable land, though answering this description, was never considered sufficiently good for the crop, and the almost invariable practice of the older growers was to search for and hire the richest pastures obtainable. Pastures which would not fatten bullocks were considered unsuitable for the needs of this exacting crop. Blith tells us that there was "not much land fit for this design in many countries," and goes on to say that "Your best and naturallest parts of England for woad are some parts of Worcestershire, and Warwickshire Southward, Oxfordshire, Gloucestershire, Northamptonshire, Leicestershire, some part of Rutland, Bedfordshire, Buckinghamshire, and some other places here and there." The land was cropped for two or three, or in the case of exceptionally rich land, for four years. Then fresh land had to be found, broken and cropped again. Woad growing was therefore a more or less nomadic industry, and consequently the machinery used in the preparation of the crop for market had to be of the simplest description, so that it might be transferred from district to district, or so cheap that its abandonment was not a matter of great moment.

After ploughing the turf well under during the autumn or winter months, every effort was made to secure a perfect tilth by repeated harrowing and rolling. On this the seed was broadcasted at the rate of two or three bushels per acre, or in later times drilled in rows eight or ten inches apart. In the fens the fields were frequently laid out in lands some twelve feet wide, and the traffic during harrowing, weeding, &c., was confined as far as possible to the alley ways between them. Sowing was carried out at intervals between the middle of March and the end of April, with the object of securing a succession of crops. Weeding, even on this freshly broken land, was generally necessary early in June, and the opportunity was then taken to single the plants, and in the case of broadcasted crops to fill in any blank spaces by transplanting This work was usually carried out by women and children equipped with short-handled spuds. Where alley ways were left between the lands the weeds and waste plants were dragged out into them.

The ingathering of the first sown crop began early in July, when the plants were from six to twelve inches high, and the first leaves were fully grown. Its fitness for harvest was determined by the colour of the leaves, and not by the size of the plants. When at their best for the manufacture of woad they were bluish green in colour. If the plants were left to grow so as to secure a larger yield this changed to a yellow green tint, and the woad prepared from them was of an indifferent quality.

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[1] Most of the notes on which the following account of woad growing is based were made at Parson's Drove between 1900 and 1905. The photographs from which the illustrations were prepared were taken in 1914 or 1915, I am not sure which.

On plucking or "cropping" the plants the leaves were torn off with a single twist in such a fashion that the young stem of the plant was left uninjured. They were then pressed into wicker skeps, which in turn were emptied into large box-shaped carts for transference to the mill. Throughout the cropping great care was taken not to include the leaves of any other plants, or leaves covered with grit, since the presence of either of these was injurious to the finished product. After stripping the foliage the crop was again hoed and cleaned; and in six weeks time, under favourable weather conditions, it was ready for a second picking. A third was generally secured, but the five or six croppings the older writers mention seem to be an exaggeration. Any subsequent growth was fed off by sheep, unless seed was required, when a part of the crop was left for this purpose after the second picking. Late in the following spring these plants pushed up airy plumes of mustard yellow flowers, which were followed by the curious, winged, nut-like

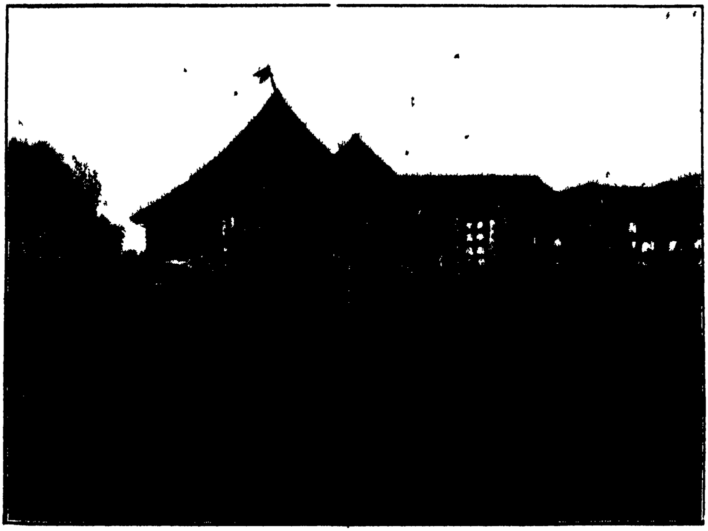

FIG. 1 General view of woad mill and ranges

fruits. These were generally ripe and ready for harvest just before the cropping season commenced in the following year.

On reaching the mill the manufacturing process began immediately. The first operations were to get the leaves into a condition in which they could be stored until there was an opportunity to complete the preparation of the woad. For this purpose they were milled to a stiff paste, and dried. The thatched conical building seen in the first illustration contains the machinery for this process. It is built in a rough and ready fashion of wooden uprights and weather boarding. The milling floor, some twenty-seven feet in diameter, is paved with slabs of stone, over which the crushing wheels roll (Fig. 2). Each wheel is a massive, obtusely conical structure, built of two strong wooden discs, joined together somewhat in the fashion of an overshot water wheel, with bands of iron two inches broad and half an inch or more in thickness. The bands are lapped over on to the timber bases, and bent at right angles so as to expose a series of dull cutting edges, some forty in number, on each wheel. The outer face of the wheel is about 7½ ft. in diameter, the inner 6 ft. Running through each is an axle pivotted to a central pole, and prolonged externally for the attachment of horse gear. In order to obtain a direct pull on these axles the horse track is raised between two and three feet

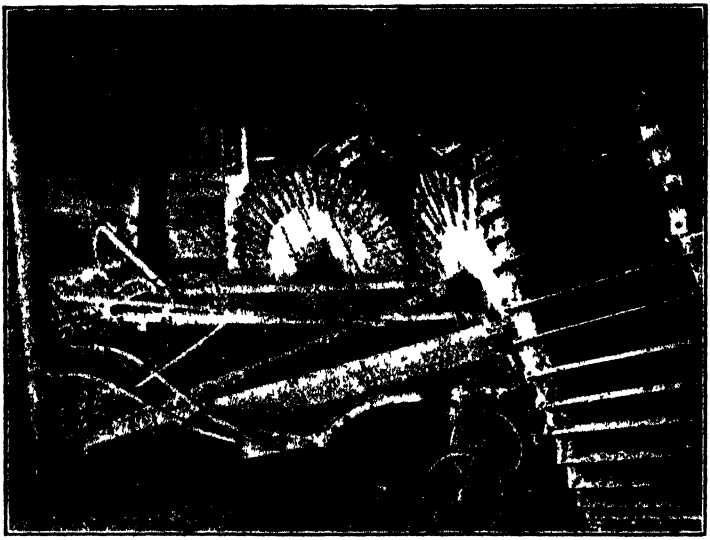

FIG. 2 Interior of woad mill showing crushing wheels

above the level of the floor, and kept in position by rough stakes and boards.

The leaves were tipped out on to the stone floor, and kept in position for grinding by means of wooden sweeps. When thoroughly pulped they were raked into heaps ready for balling. The equipment for this process is shown in the third illustration. A workman stood over one of the "balling horses," that is one of the two steeply inclined tables seen towards the bottom left hand corner, took a large double handful of the pulp, and by kneading and rolling it on the "horse" converted it into a ball. This was then transferred to a tray on the sloping "form" placed alongside him. When the tray was filled it was pushed up the form to the position seen in the illustration, and thence transferred on the padded head of another workman to one of the drying ranges. To enable him to get it into position as easily as possible the end of the form was cut into in such a fashion that it consisted of two prongs between which he could insert his head. This part of the work was done quickly, one man keeping pace with the output of each wheel of the mill. During its progress the men's hands and faces became stained with an almost indelible black colour.

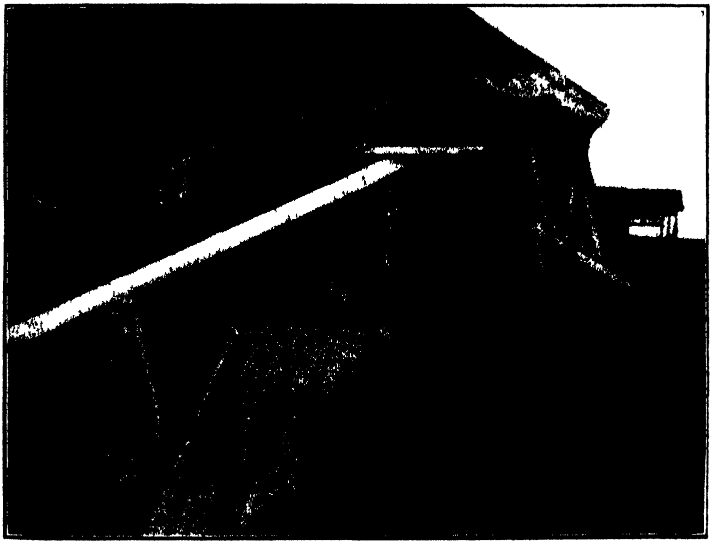

FIG. 3.—"Balling horses" and "form."

The ranges consisted of lofty, narrow, wooden frameworks, partially protected from rain by matchboard roofs. In these fleaks, or wattled hurdles, were piled, leaving ample air-spaces for the balls between them. In good weather the balls dried out in about a week's time, becoming black on the outside and a dull purplish colour internally. In this condition they were stored until the cessation of outdoor work provided the opportunity for continuing the manufacture of the finished product Meanwhile the ranges as soon as cleared were filled again and again with the material from the successive crops, until the whole had been safely housed. In storing the first, second and third pickings were kept separately

The next step was to crush the balls to a powder under the rolls, and to transfer this to the "couching house." This consisted of a low, heavily thatched structure, with thick turf walls, pierced only by a single door. The final fermentation process was started when its floor was covered to a depth of between two and three feet The whole mass was then well watered and turned, the process being repeated several times so as to distribute the moisture evenly through it. It is difficult to define the proper degree of moisture, but from material taken from a couch said to be in the right condition to secure a satisfactory fermentation one could just squeeze out a little juice by gripping a handful as hard as possible. For some three or four weeks the mass had to be turned daily, adding in the earlier days more of the powder to any portions which were too wet, or water to any which were too dry. Then it was turned on alternate days for about a fortnight, and then once or twice

FIG 4—A drying range

a week until it had tempered sufficiently. As a rule the whole process lasted for about eight weeks. The moistening of the mass caused a rapid fermentation to set in. It warmed up quickly, and a careful watch had to be kept to see that the temperature did not go higher than about 125 degrees Fahrenheit. If it showed any signs of doing so this was checked by turning the heap immediately. The temperature was estimated by the simple method of plunging the hand into the heap. But the woadman relied more on the smell of the steaming mass. This was more or less indescribable. It was markedly ammoniacal, like an unclean stable, at the same time it had some of the sickly scent of sweet silage, together with more than a hint of the stench of a cesspool. By the preponderance of one or the other of these smells, and probably of others also, the skilled woadman knew whether all was going well with this highly critical process. After being kept at the right temperature for a few days, the heap slowly cooled off and dried. At this stage it was easy to form a rough opinion as to the success of the fermentation process. If the woad had been well seasoned and tempered it would not stain the hands if rubbed between them. If the temperature had not been allowed to rise sufficiently it was "heavy," and soiled the hands when rubbed. If overheated it became "foxy," and over porous.

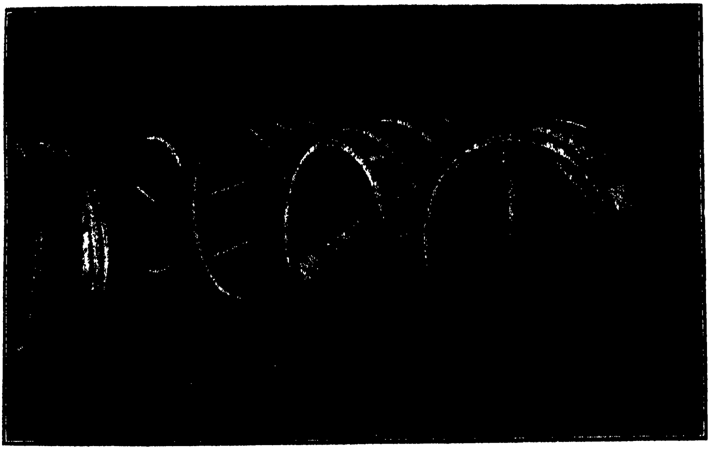

FIG 5 Woad barrels

Blith's quaint description of himself as "a lover of ingenuity" is more than justified by his evident interest in this curious fermentation process. He writes of it "how to know its seasons kindly, and so wil in time come to perfect rich woad you must observe that it wil alter and change divers times, first it wil mould, hoar and frost, and smell exceeding strong; then it will in a little time abate thereof and grow toward a black colour, and then it will hoar or mould again, and change a little whitish, and after this second change it will come to a perfect black, which the brighter and clearer the colour the better." The hoaring and frosting undoubtedly refers to the fungi which play some mysterious part in the obscure fermentation processes going on in the heated couchs.

The final stage as far as the grower was concerned was to store the woad in loose, well ventilated heaps, to await a purchaser, or to ram it tightly into large barrels, the weight being expressed by means of notches cut tally fashion on the wooden hoops (Fig. 5).

The prices obtained for the crop varied considerably with the quality. The first picking or virgin woad yielded the best material. This in recent times was worth about *20l.* a ton The value of the later croppings fell off to about *15l.*, but if the couching was faulty prices ruled as low as *5l.* or *6l.* a ton. The yield per acre varied widely with the season and the condition of the land. It rarely fell below one ton of finished woad, or went over two tons to the acre. When the costs of cultivation and manufacture are taken into account, it is obvious that the crop was hardly profitable enough to warrant the risks incurred in growing and in handling it. It seems improbable that it will ever again be cultivated on the large scale, for even its one-time competitor, indigo, has been almost killed by the synthetic product. In one respect this is unfortunate, for by proper handling some of the most exquisite blue shades can be obtained from it. But the demand could hardly be great enough to justify anyone in starting an industry which from its nature cannot be carried on on a small scale.

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CONTEMPORARY AGRICULTURAL LAW.

I.—LEGISLATION.

THERE has been in the past year legislation of very considerable importance to the agricultural interest in this country.

The Workmen's Compensation (War Addition) Act, 1917 (7 & 8 Geo. 5, c. 42), gives an additional benefit to injured workmen providing that when a workman is entitled during total incapacity caused by injury by accident arising out of and in the course of his employment to a weekly payment by way of compensation under the Workmen's Compensation Act, 1906, he shall, whether the incapacity arose before or after the commencement of the present Act, be entitled to receive from the person liable to pay the compensation, by way of addition to such weekly payment payable in respect of any week, a sum equal to one-fourth of the amount of that payment. This additional sum is to be deemed part of the weekly payment under the Workmen's Compensation Act, 1906, for the purposes of recovery of weekly payments, &c. The Act is to continue in force during the continuance of the present war and for six months thereafter.

The most important Act of Parliament from the agricultural point of view passed in 1917 is the Corn Production Act, 1917 (7 & 8 Geo. 5, c. 46). The object of the Act, as is well-known, is to carry out the policy enunciated by the Prime Minister in a memorable speech on February 23, 1917, for encouraging the growth of corn in this country by guaranteeing a minimum price for wheat and oats and securing concurrently therewith a minimum wage to agricultural labourers. Part I. of the Act deals with minimum prices for wheat and oats. These are to be for the year 1917, 60*s.* and 38*s.* 6*d.* per quarter respectively, for 1918 and 1919, 55*s.* and 32*s.*, for 1920, 1921 and 1922, 45*s.* and 24*s.* The "quarter" means in the case of wheat 480 imperial pounds, and in the case of oats 312 imperial pounds. The occupier of any land on which wheat or oats have been produced in any of these years will be entitled to be paid by the Board of Agriculture and Fisheries in respect of each acre on which he proves to the satisfaction of the Board that wheat or oats have been so produced a sum equal in the case of wheat to four times and in the case of oats to five times the difference between the "average price" and the minimum price per quarter, it being assumed that four quarters to the acre in the case of wheat and five quarters to the acre in the case of oats is the normal crop. The "average price" for the wheat or oats of any year is to be taken to be the average price for the seven months beginning on September 1 in that year ascertained from the weekly averages included in these seven months which are published under the Corn Returns Act, 1882. The person entitled to receive the payment will be the person who was on September 1 in the year in which the wheat or oats were produced the occupier of the land on which they were produced. Provision is made for adjusting cases of wheat or oats intermixed with any other crop and for withholding or diminishing the payment where land has been negligently cultivated. Cases of changes in the occupation of the land where an outgoing tenant is entitled to an away-going crop are also provided for. Of course, while, as is at present the case, the average prices of corn are above the minimum prices under the Act no claims for payment under the Act can arise. Claims for payment are to be made and determined by the Board of Agriculture and Fisheries in accordance with regulations made under the Act; but no such regulations have at present been made.

Part II. of the Act deals with the minimum wage for agricultural labourers, "agriculture" having a wide meaning for the purposes of the Act, and including the use of land as grazing, meadow, or pasture land, or orchard, or osier land, or woodland, or for market gardens or nursery grounds, and "agricultural" being construed accordingly. Section 4 imposes a penalty on any person who employs a workman in agriculture and pays wages at less than the minimum rate as fixed under the Act and applicable to the case, and it is enacted that the provisions of the section as to payment of wages at a minimum rate shall operate as respects "able-bodied men" as from the commencement of the Act (August 21, 1917), although a minimum rate of wages may not have been fixed, and that any sum which would have been payable to an able-bodied man on account of wages for time work if a minimum rate had been fixed may be recovered by the workman from his employer at any time not exceeding three months after the rate is fixed; but it is provided that no sum shall be recoverable under this provision except in a case in which and the extent to which the wages paid have not, in the opinion of the Court, been equivalent to wages for an ordinary day's work at the rate of 25*s*. a week. The minimum rates of wages for time work, and if thought necessary also for piece work, are to be fixed by the Agricultural Wages Board established by the Board of Agriculture and Fisheries after consultation with the Minister of Labour. The minimum rates may apply universally to workmen employed in agriculture or to any special class of workmen, or to any special area, or to any special class in a special area. The Wages Board are empowered to grant permits to workmen incapable by any mental or other infirmity or physical injury of earning the minimum rate, exempting them from the provisions of the Act requiring wages to be paid at not less than the minimum rate, so that they may be employed at a lower rate. In fixing minimum rates the Wages Board are so far as practicable to secure for "able-bodied men" wages which in the opinion of the Board are adequate to promote efficiency and to enable a man in an ordinary case to maintain himself and his family in accordance with such standard of comfort as may be reasonable in relation to the nature of his occupation; and in any case the minimum rate for time work must secure wages which in the Board's opinion are equivalent to wages for an ordinary day's work at the rate of at least 25*s*. a week. The expression "able-bodied man" means in the Act any male workman who is not incapable by reason of age or mental or other infirmity or physical injury of performing the work of a normally efficient workman. The expression "workmen" is much wider, and includes boys, women and girls, for all of whom therefore when employed in agriculture minimum rates of wages are to be fixed. A workman employed in agriculture on piece work, for which no minimum piece rate has been fixed, may complain to the Agricultural Wages Board that the piece rate of wages paid to him for that particular work is such a rate as would yield in the circumstances of the case to an ordinary workman a less amount of wages than the minimum time rate applicable in the case of that workman, and the Board may on any such complaint direct the employer to pay to the workman such additional sum for any piece work done by him at that piece rate at any time within fourteen days before the date of complaint, or at any time after the date of complaint and before the decision of the Board thereon, as in the Board's opinion represents the difference between the amount which would have been paid if the work had been done by an ordinary workman at the minimum time rate and the amount actually received by the workman making the complaint. The Agricultural Wages Board are empowered to establish district wages committees constituted in accordance with regulations made for the purpose by the Board of Agriculture and Fisheries. Regulations may also be made requiring the Wages Board to define the benefits or advantages (not being benefits or advantages, such as the provision of intoxicating liquor, prohibited by law) which may be reckoned as payment of wages in lieu of payment in cash and the value at which they are to be so reckoned, and to limit or prohibit the reckoning of benefits or advantages as payment of wages in lieu of cash, and to determine any question which may arise as to the value of any such benefits or advantages.

The Wages Board and various district wages committees have already been established under the Act, and regulations have been made for their constitution and procedure, and also requiring the Wages Board to deal with benefits or advantages given to workmen in lieu of payment in cash (*e.g.* cottage accommodation or allowance of food) in manner above mentioned.

Part III. of the Act is intended to prevent the benefits of the guaranteed minimum prices of corn being appropriated by landlords instead of by the actual growers, by means of the raising of rents. It prohibits by Section 8 the rent payable under any contract of tenancy made or varied after the passing of the Act in respect of an agricultural holding exceeding such rent as could have been obtained if Part I. of the Act had not been in force; and any question as to whether the rent payable under such a contract is in excess of the rent permitted by the Section is to be determined by a single arbitrator. But rent payable under a contract of tenancy will not be deemed to be in excess of that permitted under the Section unless notice in writing requiring the question to be referred to arbitration has been served on the landlord within one year from the commencement or variation of the tenancy. The Section is not to affect any proceedings by a landlord for enforcing the payment of rent except so far as the rent has before the commencement of such proceedings been determined to be in excess of the rent permitted by the Section, but any in excess of the permitted real rent paid or recovered before the award of the arbitrator will be recoverable from the landlord by way of deduction from rent or otherwise. So long, however, as wheat and oats remain as at present much above the minimum prices fixed by Part I. of the Act, it seems unlikely that Part III. of the Act can be successfully called into operation to prevent the raising of rent.

Part IV. of the Act is for the enforcement of the proper cultivation of land. The Board of Agriculture and Fisheries, if they are of opinion (*a*) that any land is not being cultivated according to the rules of good husbandry, or (*b*) that for the purpose of increasing in the national interest the production of food, the mode of cultivating any land, or the use to which any land is being put, should be changed, are empowered to serve notice on the occupier requiring him to cultivate the land in accordance with the directions of the Board for securing that the cultivation shall be according to the rules of good husbandry, or for securing the necessary change in the mode of cultivating or the use of the land, as the case may be. If compliance with any such directions involves any breach or non-compliance with any covenant or condition of tenancy the Board may suspend any such covenant or condition, and may provide for securing to the landlord such payments or other benefits (if any) as the Board may think just on account of any profit or benefit derived, or expected to be derived, by the tenant by reason of the suspension of the covenant or condition.

An appeal is given from any direction of the Board on the question whether the land has been cultivated according to the rules of good husbandry, or whether it is undesirable in the interests of food production that the proposed change in cultivation should be made. The question will be referred to the decision of a single arbitrator, to be nominated, in default of agreement, by the President of the Surveyors' *Institution. If* the occupier fails to cultivate the land in accordance with the directions given by the Board, the Board may, if the occupier in default is a tenant, either authorise the landlord to determine the tenancy, or themselves determine the tenancy; and if the occupier in default is not a tenant may enter on the land and cultivate or adapt the land for cultivation. When the Board have entered on any land they may let the land for any term not exceeding five years on such terms and conditions as they think fit, and at the best rent that can reasonably be obtained, but the owner of the land is to be sent a draft of the proposed contract of tenancy, and the opportunity is thus afforded to him of objecting to any provision therein. After a contract of tenancy has been created by the Board, the owner of the land may require the Board to withdraw, and they will be bound to do so as soon as reasonably may be. On withdrawal by the Board the land will remain subject to any tenancy created by the Board as if the tenancy had been created by the person who would but for the tenancy have been entitled to resume possession. Any person interested in any land who suffers loss by the exercise of the powers conferred on the Board over that land may claim to be paid such loss by the Board, and the claim will in default of agreement be determined by arbitration. The Board are by Section 10 given powers to prevent damage to crops, trees, or pasturage caused by rabbits or vermin, by authorising, after a reasonable opportunity has been given to the occupier and owner of destroying the rabbits or vermin, any person to enter on the land and kill and take the rabbits or vermin, and the costs of the operation may be recovered from the occupier. The Board may with respect to any area consisting of one or more counties or county boroughs authorise any body of persons constituted in the prescribed manner to exercise on behalf of the Board, subject to such appeal to the Board as may be prescribed, any of the powers under this part of the Act. In the first instance the body so constituted is to consist of or comprise the persons who immediately before this part of the Act comes into operation were acting as members of the War Agricultural Executive Committee constituted under the Defence of the Realm Regulations for the area affected.

It will be seen that the above provisions of Part IV. cover much the same ground as the numerous Defence of the Realm Regulations with a view to maintaining the food supply of the country, which have been so largely affecting the course of agriculture for the last year, and the administration of which has been in the hands of County War Agricultural Executive Committees, under the superintendence of the Board of Agriculture and Fisheries. The powers exercisable under these regulations are to cease to operate at the expiration of one year from the passing of this Act (August 21, 1917), or at the termination of the present war, whichever is the earlier, and Part IV. is then, and not before, to come into operation.

Part V. of the Act contains general provisions. The Board of Agriculture and Fisheries are by Section 12 empowered generally to make regulations for carrying the Act into effect, and in particular for requiring the Agricultural Wages Board to deal with the question of the benefits or advantages which may be reckoned as payment of wages in lieu of payment in cash, and to define for the purposes of any differential rate for overtime the employment which is to be treated as overtime employment. Section 13 gives the Board powers of entry and inspection of any land. Section 14 deals with the appointment of officers by the Board, and Section 15 empowers the Board to require occupiers of agricultural land to make returns with respect to the cultivation crops and live stock and the owner thereof. A penalty is imposed for refusal or neglect to make a return, or for making a return false in any particular.

II.—DECISIONS OF THE COURT.

1. *Labour.* Under this head there do not appear to have been any cases in the past year having any special bearing on agricultural labour. It is, however, having regard to the general rise in money wages which has occurred throughout the country, desirable to notice the case of *Woodilee Coal and Coke Company* v. *McNeill* (87 L.J. P.C. 17 ; 1917 A.C. 43), in which the House of Lords held that in assessing compensation to be paid to a workman injured by accident arising out of and in the course of his employment and suffering partial incapacity therefrom, the arbitrator, in assessing the weekly sum to be paid for compensation, should, subject to the statutory limitation as to the amount of compensation, take into consideration a general rise or fall in the wages of the workman's trade. Similarly in *Cory Bros. & Co.* v. *Tarr* (86 L.J.K.B., 1340 ; [1917] 2 K.B., 774) the Court of Appeal held that where a workman partially incapacitated and able to do some work has since the date of the original award become able to earn an increased rate of wages owing to a general rise of wages in the neighbourhood, there is jurisdiction to review the original award and to diminish the weekly compensation payable by his employers on account of the increase in the rate of wages.

2. *Stock.* *Piper* v. *Winnifrith and Leppard* (34 Times L.R., 108) is an interesting case on the question of sheep-worrying by dogs. The plaintiff was the owner of certain sheep, and the defendants, who lived in one house, each owned a dog, neither of them being in control of the dog of the other. The dogs went out together one night without the knowledge of either defendant and attacked the plaintiff's sheep, and did damage, as he alleged, to the amount claimed. The plaintiff sued in the County Court, and the defendant Leppard paid into Court a sum equal to half the damage claimed. The County Court Judge gave judgment for the plaintiff for half the damages claimed against Winnifrith, and as the defendant Leppard had paid into Court the other half, he gave judgment in his favour with costs. The plaintiff appealed and claimed judgment for the full amount of the damages against each defendant. The King's Bench Divisional Court dismissed the appeal, holding the County Court Judge's decision to be right. They said that the mere fact that the dogs acted together did not make their owners joint wrong-doers, and therefore the Judge was entitled to divide the damages as he had done. It was a reasonable inference of the Judge to draw that each dog had probably done about half the damage, and that there was no presumption of law that the dogs acted jointly.

In *Wellaway* v. *Courtier* (87 L.J.K.B. 299 ; 1918, 1 K.B., 200) a question arose as to damages by straying sheep to a crop of swedes. The plaintiff bought a crop of swedes in a field with a proviso that half the crop should be consumed on the land, and the defendant bought a crop of grass in an adjoining field from the same vendor. The plaintiff was alleged to have left the gate into his field open, and some of the sheep went through one day and ate some of the swedes. On subsequent days the sheep all went into the field, but not through the gate, and damaged the swedes. It was contended on behalf of the defendant that he was not liable, as the plaintiff had not exclusive possession of the turnip field, he only having the right to half the crop; but the Court held that the proviso that half the crop should be consumed on the land did not disable the plaintiff from suing. The temporary property in the soil was in the purchaser of the swedes whether he had the right to remove or only to consume them on the land. But if it was found that the gate was opened on the first day by the plaintiff or his servants that would prevent him from suing for damages on that day on the ground that the sheep would have entered the turnip field by his leave and licence. That, however, would not alter the duty of the defendant to keep his sheep in his own field on other days. The plaintiff was therefore held entitled to damages in respect of those days.

The question of liability for yew poisoning was considered in *Cheater* v. *Cater* (1918, 1 K.B., 247). The plaintiff was yearly tenant of a farm owned by the defendant. A fence separated a field in the plaintiff's farm from land in the defendant's occupation. About three feet from the fence the defendant had a shrubbery of box, laurel and yew trees, and on January 4, 1917, two of the yew trees overhung the fence by two feet. A mare which was in foal belonging to the plaintiff in his field ate of the yew branches and died in consequence. The plaintiff said that he did not know of the existence of the yew trees or their poisonous nature. He brought an action for damages for the loss of the mare. The County Court Judge held that the defendant was not liable. The Divisional Court to whom the plaintiff appealed affirmed this decision. The case then came before the Court of Appeal, and they upheld the previous judgments that the defendant landlord was not liable. They referred to a case of *Erskine* v. *Adeane* [1873] (42 L.J.Ch., 835; L.R. 8 Ch., 756), where the facts were very similar, and Lord Justice Pickford said that a tenant took property demised to him as it was. If he took it with this poisonous shrub near it he took it as it was, and he could not complain if he suffered damage by reason of something which was there at the date of the demise. The tenant had not shown any material alteration in the state of things at the time of the demise and when the loss took place so as to establish the liability of the defendant. A case such as this between landlord and tenant is to be distinguished from a case like *Crowhurst* v. *Amersham Burial Board* [1878] (48 L.J.Ex., 109; 4 Ex.D., 5), where landowners who planted a yew tree on their land which grew through and beyond the fence were held liable for the loss of a horse poisoned by the yew belonging to the tenant of another landowner.

The practice of agistment was dealt with in a County Court case of *Coldman* v. *Hill* (7 L.J. County Courts Rep., 11), which is worthy of notice. The plaintiff sued for the loss of two cows delivered by him to the defendant on April 21 under a contract of agistment to graze on his farm for a fixed sum per head two cows which were in calf. On June 28 the plaintiff went to fetch the two cows away, and the defendant's foreman informed him that they had been taken away on June 5. This was the first intimation the plaintiff had of the removal, and they had in fact been taken away by two men who were thieves. The defendant's stockman had reported to the defendant about June 7 that the cows had been taken away by two men who could not be identified, but the defendant did not communicate with the plaintiff or the police or take any other step in the matter. The cows could readily have been identified, and being heavy in calf, it was not possible to move them far on foot. The County Court Judge held that there was an implied obligation on the defendant to act in respect of the agisted cows as a reasonably prudent man would act with regard to property of his own, and he was not exonerated from liability by the fact that the animals were stolen. Having failed to give prompt information of the theft to the owner he was guilty of a neglect of duty which rendered him liable for the loss.

3. *Landlord and Tenant.* The right of a tenant to claim for planting fruit trees and making other market garden improvements under the provisions of Section 42 of the Agricultural Holdings Act, 1908, was dealt with in *Re Morse and Dixon* (87 L.J.K.B., 1). The tenant entered at Michaelmas, 1895, under a lease for a term of twenty-one years. He had previously been in the occupation of adjoining lands, which he cultivated as a market garden, and the lessors when granting the lease were aware that the tenant was intending to use the land demised also as a market garden. Between September 29, 1895, and January 1, 1896, the tenant ploughed the greater part of the holding, but such ploughing although intended to prepare the land for use as a market garden would have been equally suitable for ordinary agricultural purposes. It was not until after January 1, 1896, that the tenant planted fruit trees and fruit bushes, and generally cultivated the property as a market garden. At the expiration of his tenancy at Michaelmas, 1916, he claimed to be entitled to compensation for fruit trees and bushes planted by him under Section 42, Sub-section 2 of the Act on the ground that the holding was on January 1, 1896, "a holding in use or cultivation as a market garden with the knowledge of the landlord." It was held by the Court of Appeal that he was not so entitled, as the cultivation which had taken place prior to that date was not sufficient to establish that the holding was then in use or cultivation as a market garden notwithstanding the tenant's intention so to use it, and that he in fact did subsequently so use and cultivate it. The lease contained a clause that if the tenant should plant any part of the land with fruit trees, bushes, or plants, and should desire at the expiration of the tenancy to remove them, he should be allowed time to do so, provided, nevertheless, that if the lessors should desire to purchase the same they should give the tenant three calendar months' notice, and pay him the fair value thereof to an incoming tenant. This clause was held not to be such a consent in writing by the lessors to the making of the improvement as is required to bring a case within Section 2 of the Act, which enables a tenant to obtain compensation for

fruit trees and bushes planted with the landlord's previous consent in writing.

The case of *Green* v. *Lyon* (6 L.J. County Court Rep. 75) in the Worthing County Court is worthy of notice. There his Honour Judge Mackarness held that an arbitrator in considering whether a tenant is entitled to compensation for unreasonable disturbance under Section 11 of the Agricultural Holdings Act, 1908, was entitled to take into consideration the negotiations which took place between the landlord and tenant subsequent to the giving of the notice to quit in order to determine whether such notice was "without good and sufficient cause, and for reasons inconsistent with good estate management."

North London and General Property Co. v. *Moy* (34 Times L.R., 227) raised an important question as to the duty of a tenant to produce to his landlord the receipt for income tax when claiming to deduct from the rent the amount paid by him to the Inland Revenue. The Court of Appeal reversing a decision of Mr. Justice Low, held that he was not bound to produce the receipt before action though the landlords had not acted unreasonably in requesting to see the receipt, and they disallowed the tenant the cost of the action to recover the rent.

In *Westacott* v. *Hahn* (34 Times L.R., 257) the plaintiff was lessee of a farm, and the lease contained a covenant by the tenant to do the repairs in the following words : "will from time to time during the said term at his own cost (being allowed all necessary materials for this purpose (to be previously approved in writing by the lessor) and carting such materials free of cost a distance not exceeding five miles from the farm) when and so often as need shall require well and substantially repair, &c." The lessor had not called upon the tenant to execute any repairs under his covenant, but the tenant had applied to the lessor for the materials necessary to put the premises in repair in accordance with the terms of the covenant. This the lessor failed to do, and the tenant brought an action claiming damages for the lessor's failure to supply materials, contending that the above-stated clause contained a covenant on the lessor's part to supply materials when required for repairs by the tenant. The Court of Appeal held that there was no covenant by the lessor to provide materials, but that the words "being allowed all necessary materials," &c., were merely a qualification of the tenant's covenant to repair and leave in good repair. The lessor was therefore not liable for failure to supply materials, though of course not having done so he could not hold the tenant liable for non-execution of repairs for which the materials were required. The Court also held that the lessee could not give evidence of a custom by which the lessor would be bound to allow materials necessary for the repair of the premises, as such a custom would be inconsistent with the terms of the lease.

Blane v. *Francis* (86 L.J.K.B., 364 ; [1917] 1 K.B., 252) was a case where a lessee was under the covenants of his lease bound to repair. The lease expired, and he held over on a verbal agreement as yearly tenant on the terms of the expired lease, and the plaintiff who had bought the property from the original lessors since the expiration of the lease brought an action against the lessee for damages for breach of the covenant to repair. It was held that the agreement under which the lessee held not being in writing the plaintiff as assignee of the original lessor was not entitled to sue the tenant in respect of breaches of the repairing covenant contained in the expired lease.

4. *Produce.* There have been several cases in respect of the sale of milk and alleged adulteration thereof. In *Cox* v. *Evans* (86 L.J.K.B., 539 ; [1917] 1 K.B., 275) the appellant was a milk vendor who supplied milk under a written contract to Crocker, a dairyman at Briton Ferry. It was a term of the contract that the milk should be delivered to the purchaser at the railway station, and that arrival of the milk at that station should constitute delivery by the vendor to the purchaser. The appellant consigned a churn of milk to Crocker at Briton Ferry Station, and on its arrival it was seized by an inspector and a sergeant of police, who retained it in their possession, and prevented the consignee from touching it until the respondent an inspector under the Sale of Food and Drugs Acts arrived at the station about twenty minutes later. The respondent then took a sample of milk from the churn, and as the result of an analysis laid an information against the appellant under Section 6 of the Sale of Food and Drugs Act, 1875 (38 and 39 Vict., c. 63), alleging that the respondent had procured at the place of delivery a sample of milk then "in course of delivery," and it was not of the nature, substance, and quality of the article demanded by the purchaser. The Justices who heard the information found that the sample was procured "at the place of delivery" and "in course of delivery" to the purchaser or consignee in pursuance of the contract for sale to such purchaser or consignee of the milk as required by Section 3 of the Sale of Food and Drugs (Amendment) Act, 1879 (42 and 43 Vict., c. 30), and they convicted the appellant, as the certificate of the public analyst showed that the sample contained eighteen parts by weight of added water. A case was stated for the decision of the Divisional Court, raising the question whether when the sample was taken the delivery had been completed, or whether the sample was taken "in the course of delivery," as required by the Act. That Court held

that the question was one of fact for the Justices, and that there was evidence to support their finding, and therefore that the Court could not interfere with it. They held also that even if the question was one of mixed law and fact the Justices had come to a right conclusion, and the conviction must be affirmed.

In *Bowen* v. *Jones* (86 L.J.K B., 802) the appellant was charged under the Sale of Food and Drugs Act, 1875, with selling milk which was deficient in milk fat according to the percentage required by the Sale of Milk Regulations, 1901, which provide that when a sample contains less than 3 per cent. of milk fat it shall be presumed, until the contrary is proved, that the milk is not genuine by reason of the abstraction therefrom of milk fat or the addition thereto of water. She contended that the deficiency was due not to interference with the milk but to the feeding of cows, in which case she would not have been liable, as was held in the case of *Hunt* v. *Richardson* (85 L.J.K.B., 1360 ; [1916] 2 K B., 446), which was noted in the article on Contemporary Agricultural Law in this Journal for 1916. The appellant, however, did not prove to the satisfaction of the Justices control of the milk during the whole period from the time of milking until the sale, so that there could have been no possibility of tampering with the milk during that period. Therefore, not finding that the deficiency was due to the feeding of the cows the Justices convicted the appellant, and the Divisional Court held that upon the evidence they were justified in so doing.

Pugh v. *Williams* (86 L.J.K.B., 1407) was a case where the respondent, who was charged with selling milk not of the nature, substance and quality demanded, the milk being shown to be deficient in milk fat, relied upon a warranty as a defence to the charge under Section 25 of the Sale of Food and Drugs Act, 1875, which makes it an answer to such a charge that the defendant purchased the milk as genuine, and with a written warranty to that effect that he had no reason at the time when he sold it to believe that it was otherwise, and that he sold it in the same state as when he purchased it. The respondent proved that he had purchased under a contract in writing by which a farmer agreed to sell and deliver a quantity of milk fresh and with all its cream daily at Kilburn railway station ; but the farmer's responsibility with regard to the quality and condition of the milk in all respects was to cease upon its arrival at Kilburn station. The milk in question arrived at the station, and was fetched away by the respondent after it had been at the station nearly three hours, and no evidence was given by the respondent that it had not been tampered with during this interval so as to throw the responsibility for the deficiency on the farmer. It was held by the King's Bench Divisional Court that the respondent was not entitled to rely upon the warranty as a defence to the charge as he had not satisfied one of the conditions of Section 25 of the Act of 1875, and proved that he sold the milk in the same state as he bought, for it might have been tampered with during the interval between the time when it was delivered at the station and when it was fetched away. *Elder* v. *Bishop Auckland Co-operative Society* (86 L.J.K.B., 1412) was a similar case where the respondents purchased milk from a dairy farmer under a contract by which the latter agreed "to supply . . . milk carriage paid" with a warranty of quality. The milk being found deficient in quality the respondents were prosecuted, and set up this warranty as a defence to the charge; but in this case again the milk had been left nearly three hours at the railway station before it was fetched away. It was held that the burden of showing what happened after the delivery at the station was on the respondents which they had not discharged, and they were therefore not protected by the warranty.

5. *Miscellaneous.* In these days when there is a bewildering multiplication of statutory rules and orders affecting farmers, graziers, butchers and producers of food generally, which it is difficult for any one to keep pace with, the case of *Johnson* v. *Sargant and Sons* (87 L.J.K.B., 122; [1918] 1 K.B., 101) is worthy of attention. The Food Controller made an Order called the Beans, Peas and Pulse (Requisition) Order, 1917, under regulation 28 of the Defence of the Realm Regulations. The Order was dated May 16, 1917, but it first became known to the parties to these proceedings and to the public generally by an announcement in the newspapers on the morning of May 17. If the Order came into force like an Act of Parliament which operates from the commencement of the day on which it is passed, unless some other day is fixed for its coming into operation, a certain contract for the sale of beans made on May 16 was void. The Court, however, held that the rule as regards an Act of Parliament does not apply to a statutory order which will only come into operation when it becomes known by publication, and that therefore the Order in question did not operate until May 17. In *Hussey* v. *Exeter Corporation* (118 L.T., 13) the Corporation of Exeter, acting under the powers conferred by regulation 2L of the Defence of the Realm Regulations and the Cultivation of Lands Order (No. 2), 1917, for the purpose of increasing the food supply, entered upon a partly cultivated field occupied by the plaintiff and used by him as a poultry run and for grazing sheep with the view of letting it for allotments. The plaintiff disputed their

right of entry, alleging that the national food supply would be decreased and not increased by the action of the Corporation. It was held by Mr. Justice Eve that there was no jurisdiction to override or interfere with the decision of the Corporation to take the land in question, there being no want of *bonâ fides* in their proceedings.

Bruce v. *Caulfield* (34 Times L.R., 204) was a case where it was sought to render the defendant liable for the fall of a poplar tree growing on the defendant's ground, which was blown down in a gale and fell on to the plaintiff's ground and did damage. A similar tree had been uprooted about three months before, but without causing damage. The plaintiff had never made any complaint that the tree was dangerous. It was held that there was no evidence of negligence which would render the defendant liable. The fact that another tree had fallen three months previously was considered not to affect the case, because there was nothing to show whether it was sound or unsound, and that the tree was blown from its roots, not broken off, like the tree which caused damage.

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AGRICULTURAL STATISTICS, 1917.

[The Society is again indebted to the Board of Agriculture and Fisheries for their kindness in supplying, for inclusion in the Journal, the usual detailed and comparative tables of the latest agricultural statistics. For fuller information than can be given in the small space available here, the Department's own admirable series of Reports on Agricultural Statistics should, of course, be consulted.—ED.]

ACREAGE.

In Table I. particulars are given of the acreage under the various crops and the number of each class of live stock. Under the stimulus of war conditions, the total area of agricultural land in Great Britain shows for the second year in succession an increase after the previous quarter of a century of shrinkage, the gain in England and Wales[1] being 7,400 acres, which, though relatively small, is highly significant of the efforts being made throughout the country to bring every available acre into cultivation. If to the increase thus recorded in farm lands is added the thousands of allotments taken from derelict building 'land, public commons, private parks, &c., the grand total of additional land under cultivation in 1917 must be very considerable. The annual agricultural returns are, however, confined to holdings exceeding one acre, and in the absence of a special return, no statistical measure is available of the present area of allotments. Apart from the effort to bring waste land into use, the principal objective of the Food Production Department has been the ploughing up of grass land, and the results of their efforts in this direction on the 1916-17 cropping (the Department was only established at the beginning of 1917), are seen in the gain in England and Wales of nearly 200,000 acres of arable land. Although this is only a tenth part of the total increase over 1916 which the Food Production Department hope to secure for the 1918 crops, it is a satisfactory earnest of what will be accomplished now that the difficulties in supplying tractors and labour are being overcome. The net transfer of permanent grass to arable land in 1917 was 187,000 acres, which was three times the amount broken up in the previous year, with the cumulative result that the total area of pasture land in England and Wales in 1917 was the smallest for ten years past.

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[1] Although for purposes of reference Tables I. and II. give details also for the other parts of the United Kingdom, exigencies of space make it necessary to confine the review more particularly to England and Wales.

Turning to individual crops it will be noticed that there was an addition of 50,000 acres (about 2½ per cent.) to the **Wheat** area in the United Kingdom as a whole, and that even this somewhat disappointing result was only secured by increases in Ireland and Wales, England, the predominant partner in wheat growing, actually suffering a shrinkage of 7,000 acres. The acreage under wheat in England in 1917 was no less than 267,000 acres (12 per cent.) below the high record of 1915. **Barley**, despite the lessened demand for alcoholic distillation, showed an increase in every country except Scotland, the gain in England and Wales being nearly 130,000 acres (10 per cent.), which is particularly significant when it is remembered that there was a gain of 100,000 acres in the previous year. In the area sown to **Oats** there was also a very considerable increase, the figure for the United Kingdom being over 600,000 acres, or nearly 15 per cent. above that of 1916. Although the greater part of the increase was in Ireland, Great Britain did well, and the gain of 174,000 acres in England and Wales made the total area under oats south of the Tweed the highest since 1904, and the area in 1917 has only been exceeded twice in the last thirty years. **Rye** is comparatively unimportant in the United Kingdom, but here again an increase (3,000 acres) was shown. Taking the four corn crops together, the total acreage under corn in 1917 in the United Kingdom as a whole was 8,761,000 acres, an increase of 817,000 (or over 10 per cent.) on 1916. In England and Wales the increase was 310,000 acres, making the total acreage under corn over 100,000 acres greater than in any year since 1900.

Of the pulse crops **Beans** again showed a considerable shrinkage, and the area sown in England (209,000 acres) is the smallest on record. The total decline of beans in England since 1914 now amounts to over 83,000 acres (nearly 30 per cent.). **Peas** showed the slight increase of 18,000 acres in England, but the area was 38,000 acres less than before the war. The combined area under the two pulse crops in England in 1917 was some 340,000 acres, as against an average of 230,000 acres in the three years preceding the war. The stimulus given to the cultivation of the **Potato** by the famine of last Spring is demonstrated effectively by the increase in the area planted in the United Kingdom as a whole of over 220,000 acres (20 per cent). In England alone 74,000 acres (18 per cent.) were gained, and in Wales 6,000 acres (21½ per cent.). Not only was the drop of 36,000 acres between 1915 and 1916 thus completely nullified, but in the result the area planted with potatoes in England and Wales in 1917 was 74,000 acres greater than the average of the five years preceding the war, and was the highest ever recorded. The total area under this ubiquitous food crop in 1917 must have also been very considerably augmented by the war allotments, on which in most cases it was by far the most popular experiment.

Adding the corn crops to potatoes, the total area in England and Wales in 1917 under the crops most immediately available for human food was 6,500,000 acres, an increase of 250,000 acres compared with the average of the five years preceding the outbreak of war.

The principal **Root Crops** showed a fairly substantial increase in England and Wales, turnips and swedes increasing by 34,000 acres (just over 3½ per cent.), and mangolds, after having declined considerably both in 1915 and 1916, reviving by 11,000 acres in 1917. The extent of the three crops together, however, was 116,000 acres (8 per cent.) less than in 1914.

Similarly to permanent grass, the **Rotation Grasses** were drawn on for the increased corn and potato acreage, and the area under clover, sainfoin, &c., in Great Britain as a whole, fell by 83,000 acres, although there was a small increase in Scotland. In England and Wales there was a loss of 91,000 acres, which, however, was not sufficient to cancel the increase of 232,000 acres in the previous year, with the result that the area in 1917 was still over 100,000 acres greater than in 1914, thus showing that there is still a margin in hand which would allow of a further reduction in order to free additional land for more essential crops.

Of the minor crops in England and Wales, **Vetches and Tares** again dwindled, the area under those crops being a lower record than even in 1916. The **Small Fruit** acreage has also shrunk regularly since the outbreak of war, and the area so allocated in 1917 is the lowest since 1904.

After the very great extent of land left as bare fallow in 1916, it is satisfactory that the area so idle was reduced in England and Wales in 1917 by 67,000 acres, which, however, still leaves the total area under recuperation 15,000 acres more than in 1914, and 30,000 acres more than the average of the five years preceding the war.

LIVE-STOCK.

The total number of **Horses** (excluding non-agricultural horses) on farms in Great Britain again increased in 1917, the addition of 31,000 on the previous year bringing the total up to nearly 1,324,000, a figure practically equal to that of the year before the war, and especially noteworthy in view of the fact that the number of horses had dropped steadily from over 1,550,000 in 1909 to only 1,210,000 in 1915. Of the total horses in 1917 there were over 930,000 actually in use for farm work (including mares for breeding), the increase of 25,000 being made up of 2,000 in Scotland and 23,000 in England and Wales, which, considering the drain on agricultural horses for military purposes in the early part of the war, is by no means an unsatisfactory position. Stallions also increased slightly, the net gain in England and Wales being about 150 (nearly 2 per cent.), and it may be recalled, moreover, that in the previous year there was an increase of about 7 per cent. in the number of such horses. With further reference to the prospects of supplies of horses in the near future, it will be noted that there was a general increase in the number of unbroken horses of one year old and above, the gain in England and Wales being 11,000 (5 per cent.). This result was the natural sequence of the large increase of foals in 1916, when there were 11 per cent. more than in 1915. The number of foals in England and Wales in 1917, however, showed a decline of over 5,000 (6 per cent.).

In view of the present meat shortage, the **Cattle** returns are of special interest, although probably the position in June, 1917, when the statistics under review were collected, has changed considerably by now. At the date to which the returns relate, the total number of cattle in Great Britain, although showing a slight decrease (5,000), was practically as great as in the record year of 1916, and was 470,000 greater than in the June before the war. Despite the adverse conditions due to the war, the thriving British cattle industry has thus, at the end of three years of war, proved more prosperous than ever. The slight decrease in the total, as compared with 1916, was confined to Scotland and Wales, there having been a further increase in England of over 20,000 head. Unfortunately, the milking herd was again reduced, the number of cows and heifers in milk in Great Britain falling by 32,000, or 2 per cent. There has been a decline in the milking herd each year during the war, and the total number in England in 1917 was 67,000 less than in the June preceding the outbreak of war. On the other hand, the breeding prospects improved, there being an increase in the number of cows and heifers in calf of 68,000 in Great Britain as a whole, and 59,000 in England and Wales alone, the total numbers in the two latter countries standing at 633,000, as against 576,500 in 1914. As far as beef cattle were concerned, although the supply of mature beasts (two years old and over) fell by nearly 9,000 in Scotland, and by 2,000 in Wales, it increased by 28,000, or almost 3 per cent., in England, the net change in Great Britain as a whole being an increase of over 17,000, making an increase of 130,000, as compared with the pre-war figures. The young stock of one year and under two increased in Wales by 3,000, but in England, notwithstanding the increased number of calves in 1916, the young stock in 1917 declined by over 33,000 (3 per cent.). The number of calves in 1917 declined all round, the decrease in Great Britain being 33,000, and in England and Wales alone 29,000, against an increase in the latter countries of 6,000 in the previous year. In the result, however, as the number of calves in England and Wales had increased from 1,270,000 in 1914 to 1,340,000 in 1916, it was in 1917 still about 40,000 above the number returned in the June preceding the war.

After having steadily increased up to 1916 by over a million above the record minimum number of 1913, the number of **Sheep** in Great Britain in 1917 declined sharply by over 960,000, and stood at about 250,000 less than in June, 1914. The net falling-off was general in the three countries, being relatively highest in Wales, where over 5½ per cent., or 212,000 were lost. In England the loss was 570,000 (4 per cent.). The decline was, however, not uniform among the different categories. Breeding ewes, for instance, continued to increase in Scotland, although shrinking by 40,000 (nearly 2½ per cent.) in Wales, and by 140,000 (2½ per cent.) in England. At the same time, the numbers of ewes in England and Wales were still well above those in 1915 and 1914. Sheep for mutton (animals one year old and above) fell by 75,000 (1½ per cent.) in Great Britain as a whole, but as the numbers were still 86,000 above those of 1914, the outlook for home mutton supplies during the present winter was not unsatisfactory compared with normal years. In England, indeed, the number available increased by 14,700, and this is particularly noticeable as following an increase of over 300,000 in 1915. Lambs declined all round, the total in Great Britain being 722,000 less than in 1916. In Wales the loss was as much as 9 per cent., although the greatest absolute decline was in England (450,000).

Pigs have been more seriously affected by war conditions than the other class of food animals, and for the third successive year the numbers kept showed a serious diminution, the loss of a further 263,000 (11 per cent.) in Great Britain. bringing the total down to 600,000 below that of 1914. The decline was particularly heavy in England where 240,000 less were kept than in 1916. Although, of course, the pig stock is capable of much more rapid renewal than that of cattle and sheep, the prospects of the supply of pork in the near future were affected adversely by the fall in the number of breeding sows of 30,000 (10 per cent.) in Great Britain, and of 29,000 (10 per cent.), in England and Wales alone, the numbers in the latter countries being in June, 1917, 86,000 less than in the corresponding month in 1914. The number of bacon pigs was similarly reduced, and in England there were nearly 250,000 less than in the previous year.

PRODUCE OF CROPS.

Although the total production of **Wheat** in the United Kingdom in 1917 (see Table II.) showed an increase of over half a million quarters on that of the previous season, it was still 1,200,000 quarters below the record of 1915, and in spite of the imperative necessity of increasing the home wheat supply, the total was only 600,000 quarters (8 per cent.) above the average of the five years preceding the war. This somewhat disappointing result was due in part to the relatively small recovery of 50,000 acres of the 430,000 acres lost in 1915, and in part to the yield per acre again being poor. In England, separately, the out-turn per acre was 1¼ bushels better than in 1916, but was 1½ bushels below the average of the previous ten years. The total crop in that country was nearly 300,000 quarters above that of 1916, but was 140,000 quarters below the pre-war average. In Scotland, where the yield per acre is usually the highest in the United Kingdom, a good average yield of 40 bushels was realised, a satisfactory improvement of 4 bushels over the poor results of 1916, and this, coupled with the slightly increased acreage, gave a total production in the northern half of Great Britain of 20,000 quarters above that of 1916. The revival in the acreage under **Barley**, despite the yield being again somewhat inferior, resulted in the total crop of that cereal in the United Kingdom, in 1917, being over 570,000 quarters (8½ per cent.) above that of 1916. In Great Britain alone the yield per acre was even lower than in 1916, but the increased acreage resulted in the total production being over 400,000 quarters above that year. Compared with the average of the five years preceding the war there was a total deficiency in Great Britain of 700,000 quarters (10 per cent.), this being due mainly to the heavy reduction of nearly 20 per cent. in the acreage which took place in 1915. In England and Wales the yield per acre was particularly poor, being lower than the meagre out-turn of 1916 by two-thirds of a bushel in England, and by over 1½ bushels in Wales, and in both countries the yield was over 2 bushels per acre below the ten-year average. Scotland, which in 1916 had suffered the worst yield on record for that country, by comparison with England and Wales secured a very satisfactory result in 1917, the yield per acre coming out at the good average of 35½ bushels, and being almost 5 bushels above the yield of 1916.

Contrasted with the under-average yields of wheat and barley, the United Kingdom **Oat** crop in 1917 was extremely satisfactory, being 1½ bushels above the ten-year average, and 2½ bushels above the previous year. Coming, as this did, in conjunction with the highest recorded acreage under that crop, a record was also established in the total production, the crop of 26,000,000 quarters not only being 4,700,000 quarters (over 20 per cent.) above that of 1916, but also 5,000,000 quarters above the average of 1910–14. The net result was largely due to the heavy increase in Ireland, but in Great Britain by itself the yield per acre was a good average, and there was an increase in the total production as compared with 1916 of 1,375,000 quarters. This increase, however, was, as far as England and Wales were concerned, entirely due to the increased acreage, the average yield per acre in those countries again being somewhat below average. Scotland had an even more satisfactory result than with her wheat and barley, as the yield per acre of oats in that country was over three bushels above the ten-year average, and no less than five bushels above that of 1916. In Scotland, as with the United Kingdom as a whole, the total production of oats in 1917 was the largest on record, and in England and Wales it was the largest since 1907.

Taking the three corn crops as a whole, and converting their production from quarters into the actual equivalent weight of grain, it will be found that the total weight of potential breadstuffs (excluding potatoes) produced in the United Kingdom in 1917 was 132,626,000 cwts., as compared with an average of 118,954,000 cwts. per annum in the five years preceding the war.

The area of **Beans** retained for harvesting in Great Britain in 1917 was 24,500 acres less than in 1916, and reached a total of only 209,000 acres, as compared with an average of 280,000 acres in 1910–14. The bulk of this crop is grown in England, where the out-turn proved to be the most disastrous on record, the average yield per acre being only 17 bushels, a reduction of 13 bushels compared with 1916, and of 12 bushels (40 per cent.) on the ten-year average. This, together with the reduction in the acreage harvested, resulted in a deficiency of 426,000 quarters (over 50 per cent.) compared with 1916, and of 540,000 quarters (55 per cent.) compared with the average of 1910–14.

Peas are almost entirely confined to England, where the acreage harvested, which had steadily declined during the first years of the war, showed in 1917 a revival, as compared with 1916, of 16,000 acres (20 per cent.), the total being, however, still 96,000 acres below the area in 1914. Although not such a failure as beans, peas also did badly, the average yield per acre being nearly three bushels below 1916, and over four bushels below the ten-year average. As a consequence the increase compared with 1916 of 20 per cent. in the acreage harvested resulted in the production increasing by only 7 per cent. (16,000 quarters.). The total production was 170,000 quarters (38 per cent.) below the average in 1910–14.

In striking contrast to the failure of 1916, the production of **Potatoes** in 1917 was the largest on record, the increase in the United Kingdom as a whole being 3,134,000 tons (57 per cent.). The total crop was 1,000,000 tons above the previous record of 1913, and over 1,500,000 tons above the average of the five seasons preceding the war. Man's efforts in increasing the acreage over that of 1916 by 20 per cent. were strongly seconded by nature, the average yield per acre in the United Kingdom exceeding that of the previous year by 1½ tons (over 30 per cent.), and being over half a ton above the average of the last ten years. Nearly half the crop was produced in Ireland, which accounted for 1,720,000 tons of the total increase over 1916. The greatest proportionate increase was in Scotland, where the average yield per acre improved by nearly 3½ tons, with the result that although the acreage planted in that country was not more than 14 per cent. above that of 1916, the total production was more than doubled. England, which had not suffered such a disastrous yield as the other parts of the United Kingdom in 1916, nevertheless also showed a satisfactory improvement compared with that year, the average yield per acre increasing by over half a ton, and being two-fifths of a ton above the ten-year average. This, together with the gain of 20 per cent. in acreage, resulted in the total farm production in England increasing by 772,000 tons (over 30 per cent.). Wales also did well, with a yield of practically a ton per acre more than in 1916, and an increased total production of 63,000 tons (almost 50 per cent.). As already pointed out, no particulars are available of the acreage under potatoes other than on farms, but as the allotment crops would have, of course, shared in the general favourable weather conditions of 1917, the addition to the total crop from this source must have been very appreciable even in proportion to the heavy increase in farm crops.

The yield per acre of **Turnips** and **Swedes** in Great Britain in 1917 was well over the average, and was over half a ton above the slightly under-average crop of the previous year. This, together with the increased acreage, resulted in an increase in the total production in Great Britain of 1,334,000 tons (7 per cent.). The increase was entirely due to the exceptionally high yield in Scotland, where the out-turn per acre was more than five tons above that of 1916, and three tons above the ten-year average. In both England and Wales the yield per acre was under the average by about two-thirds of a ton, and was over a ton below that of 1916. In England the inferior yield nullified the increased acreage, and the total production fell by 734,000 tons (6 per cent.). The acreage itself decreased in Wales, and the production in that country declined by nearly 100,000 tons. Compared with the average of the five years preceding the war, the total production in England and Wales decreased by 1,200,000 tons (10 per cent.).

Mangolds yielded an excellent crop throughout the country in 1917, the yield per acre in England and Wales alone (very little mangolds are grown in Scotland) being 2½ tons above even the good average crop of 1916, and which following on the slight increase in the acreage resulted in an increase in the total crop in those countries of 1,140,000 cwt. (16 per cent.). Even though the increase in the acreage was insufficient to counteract the steady decline in the area sown during the first two years of the war, the highly satisfactory yield per acre in 1917 resulted in the total production being the highest since 1912.

Following the excellent crops of 1916 the **Hay** production in 1917 was very disappointing. Although the yield per acre in Great Britain from clover and rotation grasses was only slightly below average, it was nearly 4½ cwt. below the bumper yield of 1916, and together with the reduced acreage resulted in the shrinkage in the total production of 596,000 tons (16 per cent.). In England separately, where the yield per acre was also under average, and about 4½ cwt. below that of 1916, the shrinkage was 463,000 tons. Meadow hay gave very inferior returns in 1917, the yield per acre in Great Britain being over 1½ cwt. below the ten-year average, and over 3 cwt. below that of 1916. And although the total area reserved for mowing was only slightly less than in that year, the total production fell by 820,000 tons (13 per cent.). The reduction in England alone was over 700,000 tons. Adding "seeds" and meadow hay together, the total production of hay in Great Britain in 1917 was 8,456,087 tons, being a reduction of 1,415,000 tons (14 per cent.) on the 9,872,440 tons produced in the previous year. In England alone the total hay production fell from 7,972,262 tons in 1916 to 6,807,805 tons in 1917, and in Wales from 865,327 tons to 747,000 tons.

Hops in 1917 (see Table III.) proved an extremely satisfactory crop, the yield per acre being over 4 cwt. above even the over-average yield of 1916, and being 50 per cent. better than the ten-year average. There was, nevertheless, owing to the Order compulsorily curtailing the acreage to half of that grown in 1914, a considerable decrease in the total production. The extent of the decrease in production which the smaller acreage must necessarily entail in normal seasons was, however, largely obscured in 1917 by the very high yield per acre, and the reduction of 87,137 cwt. in the total production compared with 1916 was only equivalent to 28 per cent. of the 1916 crop. Compared with the average of the previous ten years the total production in 1917 fell by 133,600 cwt. (37 per cent.).

PRICES IN ENGLAND AND WALES.

Corn (Tables IV. and V.). The steady upward rise in the price of **Wheat** which had been proceeding from the completion of the 1916 harvest to the beginning of January, 1917 (the average price having increased from 59*s*. per quarter at the end of August, 1916, to 76*s*. per quarter in the first week of the following January) was not maintained during January, but by the end of February the price again commenced to rise, and by the middle of April it reached the remarkable figure of 85*s*. 2*d*. This was the highest average recorded since the close of the period of the Napoleonic wars, and was 51*s*. 10*d*. more than the average price ruling in the five years before the war. On April 16, however, the Food Controller issued an Order restricting the price of wheat of the 1916 crop to 78*s*. per quarter of 480 lb., and after a week or two of adjustment for transactions already commenced, the price fell accordingly and remained at about 78*s*. until the 1917 harvest was ready. An Order was issued on August 14 restricting the price of wheat from the current harvest for delivery before December 1, 1917, to 73*s*. 6*d*. per quarter of 504 lb., *i.e.*, 70*s*. per imperial quarter of 480 lb. As practically all the 1916 crop was by then on the market, the corn being sold was mostly that from the new crop, and the price accordingly soon fell to the neighbourhood of 70*s*., where it remained until December. The Order having provided that wheat for delivery in December, 1917, and January, 1918, could be sold up to a maximum equivalent to nearly 71*s*. per imperial quarter, the price at

[Continued on page 121]

TABLE I.—Acreage under Crops and Grass; *and* Number *of* Live *Scotland, Great Britain, Ireland, and the United Kingdom*

	England		Wales		Scotland [4]	
	1917	1916	1917	1916	1917	1916
Total Area (excluding water)	Acres 32,387,409		Acres 4,750,155		Acres 19,069,683	
Total Acreage under Crops and Grass [1]	24,322,870	24,317,993	2,758,611	2,756,091	4,776,323	4,775,506
Arable Land	10,454,149	10,302,153	791,957	748,948	3,360,562	3,303,741
Permanent Grass [1] . .	13,868,721	14,015,840	1,966,654	2,007,143	1,415,761	1,471,765
Wheat	1,854,870	1,862,211	63,615	49,997	60,931	63,083
Barley or Bere . . .	1,364,630	1,244,639	95,166	87,437	159,135	169,739
Oats	2,012,719	1,862 502	246,190	222,172	1,041,343	990,589
Rye	55,138	52,840	875	636	4,963	5,742
Beans	209 311	235 080	1,281	1,177	[8] 6,135	[8] 5,440
Peas	130,193	112,068	806	615	396	591
Potatoes	473,342	399,586	34,645	28,362	147,717	130,119
Turnips and Swedes . .	921,553	885,477	50,821	52,682	414,305	414,320
Mangold	376,912	366,818	11,930	11,319	2,415	2,347
Cabbage . . .	38 332	46 371	734	840	3,477	4,673
Kohl-Rabi .	14 491	14,496	66	109	[10] —	[10] —
Rape .	59,318	64,704	4,850	6,121	4,368	7,862
Vetches or Tares .	78,207	88,484	557	630	[9] 11,901	[9] 11,199
Lucerne . . .	49,907	53,895	306	272	6	13
Hops	18,946	31,352	—	—	—	—
Small Fruit . . .	71,211	72,418	731	811	6,810	7,127
Clover, Sainfoin, and Grasses under Rotation . .	2,226,061	2,311,207	273,484	279,043	1,487,950	1,480,329
Other Crops . . .	149,482	180 992	2,128	1,792	2,673	2,373
Bare Fallow	351,526	416,953	3,772	4,933	6,037	8,195
	No	No.	No.	No.	No.	No.
Horses used for Agricultural purposes [2] . . .	712,956	691,737	83,082	81,033	135,418	133,463
Stallions [3]	6,963	6,805	1,446	1,452	1,132	1,131
Unbroken Horses – One year and above	193,900	184,081	35,092	34,833	35,874	33,380
Unbroken Horses – Under one year	84,063	88,504	20,299	21,303	13,698	14,904
Total . .	997,882	971,127	139,919	138,621	186,122	182,878
Other Horses . . .	212,663	226,633	22,358	23,185	23,926	24,412
TOTAL OF HORSES	1,210,545	1,197,760	162,277	161,806	210,048	207,290
Cows and Heifers in milk .	1,591,308	1,606,975	240,135	248,479	346,728	354,408
Cows in calf but not in milk .	242,338	225,373	29,199	26,677	45,143	41,056
Heifers in calf	328,260	291,200	33,554	30,978	49,931	45,312
Other Cattle:—Two years and above . .	1,010,682	982,513	83,088	85,252	230,878	239,254
" " One year and under two	1,148,103	1,171,714	205,219	202 375	292,453	297,620
" " Under one year	1,103,790	1,125,890	211,472	218,355	244,726	248,724
TOTAL OF CATTLE .	5,424,481	5,403,665	802,667	812,116	1,209,859	1,226,374
Ewes kept for Breeding . .	5,247,246	5,382,921	1,624,783	1,664,186	3,027,001	3,018,780
Other Sheep:—One year and above . .	2,832,990	2,818,250	730,530	778,711	1,212,040	1,253,733
" Under one year	5,422,108	5,870,783	1,312,200	1,436,272	2,634,193	2,783,351
TOTAL OF SHEEP	13,502,344	14,071,954	3,667,513	3,879,169	6,873,234	7,055,864
Sows kept for Breeding . .	226,693	253,754	27,598	29,243	14,794	17,588
Other Pigs	1,509,829	1,723,712	154,421	161,232	118,151	128,802
TOTAL OF PIGS .	1,736,522	1,977,466	182,019	190,475	132,945	146,390

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[1] Not including Mountain and Heath Land.
[2] Including Mares kept for Breeding.
[3] Above two years old, used, or intended to be used, for service.
[4] Furnished by the Board of Agriculture for Scotland.
[5] Figures for Jersey include Water.

Stock, *as returned on June* 4, 1917 *and* 1916, *in England, Wales, (including the Isle of Man and the Channel Islands).*

—	Great Britain		Ireland[7]		United Kingdom.	
	1917	1916	1917	1916	1917	1916
Total Area (excluding water)	Acres 56,207,247		Acres 20,247,294		Acres 76,639,994[5]	
Total Acreage under Crops and Grass[1]	31,857,804	31,849,590	14,350,514	14,714,277	46,332,752	46,687,512
Arable Land . . .	14,606,668	14,354,842	5,045,839	5 050 234	19,748,275	19,499,475
Permanent Grass[1] . . .	17,251,136	17,494,748	9,304 645	9,664 043	26,584,477	27,188,037
Wheat	1,979,416	1,975,291	124,082	76,438	2,105 929	2,053,568
Barley or Bere	1,618,931	1 501,815	177,135	150,063	1,797,227	1,653,876
Oats	3,300,252	3,075,263	1,463,737	1,071,593	4,789,010	4,171,353
Rye .	60,976	59,218	7 640	6,611	68,797	65,971
Beans[8]	216,727	241,697	1,365	998	218,244	242,808
Peas	131,395	113,274	268	148	131,744	113,474
Potatoes	655,704	558,067	709,263	580,308	1 377,311	1,155 404
Turnips and Swedes	1,386,679	1,352,479	293 452	262,814	1,688 146	1,623,161
Mangold	391,257	380,484	93,074	80 434	485 230	461,823
Cabbage, Kohl Rabi & Rape[10]	125,636	145,176	25,814	37,282	152 195	183,346
Vetches or Tares[9] .	90,665	100,313	2 668	2,121	93,524	102,629
Hops	16,946	31,352	—	—	16 946	31,352
Small Fruit . .	78,752	80,356	[6] 17,024	[6] 15 567	[6] 96,041	[6] 96,250
Clover, Sainfoin, and Grasses under Rotation	3,987,495	4,070,639	2,008 139	2 649 906	6,037,483	6,763 011
Other Crops	204,502	239 337	122,208	109,951	328 533	351,459
Bare Fallow	361,335	430,081	—	—	361,925	430,495
	No	No	No.	No	No.	No.
Horses used for Agricultural purposes[2] . .	931,456	906,233	389,711	382,271	1,327,252	1,294,664
Unbroken Horses (including stallions). One year and above	274,407	261,682	100 931	83 843	376 867	346,962
Unbroken Horses (including stallions). Under one year	118,060	124,711	56,530	67,037	175,428	192,589
TOTAL OF HORSES .	1,323,923	1,292,626	547,172	533,151	1,879,547	1 834,215
Cows and Heifers in milk or in calf	2,906,596	2,870,458	1,591,725	1,611,697	4,514,553	4,499,821
Other Cattle:—						
Two years and above .	1,324,648	1,307,019	1,010,588	1,034 376	2,338,207	2,344,667
One year and under two .	1,645,775	1,671,709	1,102,261	1 120 482	2,756,972	2,801,698
Under one year . . .	1,559,988	1,592,969	1 202,892	1 203,886	2,771,454	2,805,854
TOTAL OF CATTLE	7,437,007	7,442,155	4,907,466	4,970 441	12,381,186	12,451,540
Ewes kept for Breeding .	9,899,030	10,065,887	1,510,940	1,503,500	11 444,673	11,603,904
Other Sheep:—						
One year and above . .	4,775,560	4,850,694	744,987	720 298	5,527,120	5,576,513
Under one year .	9,368,501	10,090,406	1,488,526	1,539,907	10,895,451	11,669,238
TOTAL OF SHEEP	24,043,091	25,006,987	3,744,453	3,763,705	27,867,244	28,849,655
Sows kept for Breeding .	269,065	300,585	104,027	132,246	374,320	434,464
Other Pigs . . .	1,782,401	2,013,746	843,545	1,158,048	2,633,696	3,181,427
TOTAL OF PIGS . .	2,051,486	2,314,331	947,572	1,290,289	3,008,016	3,615,891

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[6] Figures for Ireland include Orchards.
[7] Furnished by the Department of Agriculture and Technical Instruction for Ireland.
[8] Figures for Scotland relate only to Beans harvested as corn.
[9] Figures for Scotland include Beans, Mashlum, &c., for Fodder.
[10] Kohl-Rabi was not separately distinguished in Scotland.

TABLE II.—Total Produce, Acreage, and Yield per Acre *of* 1917 *and* 1916, *with the Average*

Crops	Total Produce		Acreage		Yield per Acre		Average of the Ten Years
	1917	1916	1917	1916	1917	1916	1907-1916
WHEAT.	Qrs.	Qrs.	Acres	Acres	Bush.	Bush.	Bush.
England . .	6,954,184	6,657,781	1,854,870	1,862,211	29·99	28 60	31·49
Wales . :	210,465	177,627	63,615	49,997	26 47	26·42	27·71
Scotland . . .	304,169	283,097	60,931	63,083	39·94	35·90	39·79
GREAT BRITAIN . .	7,468,818	7,118,505	1,979,416	1,975,291	30·19	28·83	31·66
Ireland . . .	571,607	353,379	124,082	76,433	36·85	36·98	37·12
UNITED KINGDOM .	8,040,425	7,471,884	2,103,498	2,051,729	30 58	29·13	31 74
BARLEY[2].							
England . .	5,198,744	4,849,962	1,364,722	1,244,639	30·48	31·17	32·55
Wales	340,770	330,964	95,166	87,437	28·65	30·28	30·73
Scotland	704,788	647,145	159,135	169,735	35 44	30·50	35·31
GREAT BRITAIN .	6,244,302	5,828,071	1,619,023	1,501,811	30 84	31·05	32·77
Ireland .	944,776	784,479	177,135	150,063	42·67	41·82	42·86
UNITED KINGDOM .	7,189,078	6,612,550	1,796,158	1,651,874	32·00	32·02	33·75
OATS.							
England .	9,812,408	9,412,818	2,012,627	1,862,489	39·00	40·43	40·55
Wales	1,054,357	998,175	246,190	222,172	34·26	35·94	35·21
Scotland	5,446,931	4,527,536	1,041,343	990,589	41·85	36·56	38 40
GREAT BRITAIN . .	16 313,696	14,938,529	3,300,160	3,075,250	39·54	38·86	39·52
Ireland	9,708,913	6,395,253	1,463,737	1,071,593	53·06	47 74	50·00
UNITED KINGDOM	26,022,609	21,333,782	4,763,897	4,146,843	43 70	41·16	42·25
BEANS[3].							
England .	432,741	858,835	202,331	227,612	17·11	30·19	29·41
Wales .	3,569	3,542	1,068	974	26·73	29·09	27·47
Scotland . .	29,679	24,447	6,135	5,440	38·70	35·95	36·59
GREAT BRITAIN . .	465,989	886,824	209,534	234,026	17 79	30·32	29·60
Ireland . . .	8,090	5,748	1,365	998	47·41	46·08	42·66
UNITED KINGDOM .	474,079	892,572	210,899	235,024	17·98	30 38	29·67
PEAS[4].							
England .	275,392	259,014	102,374	84,847	21·52	24·42	25·69
Wales . .	1,503	1,091	588	419	20·45	20·83	22·55
Scotland . .	162	424	64	144	20·21	23·56	26·75
GREAT BRITAIN . .	277,057	260,529	103,026	85,410	21·52	24·40	25·68
Ireland . . .	1,050	561	268	148	31·34	30·32	29·04
UNITED KINGDOM .	278,107	261,090	103,294	85,558	21 54	24·41	25 81

Isle of Man.

[2] Including Bere.

[3] Excluding a certain area returned as picked or cut green amounting to 7,198 acres in England and Wales in 1917.

each of the **Principal Crops** ***in the*** **United Kingdom**[1] ***in of the Ten Years*** **1907–1916.**

Crops—*continued*	Total Produce		Acreage		Yield per Acre		Average of the Ten Years
	1917	**1916**	**1917**	**1916**	**1917**	**1916**	**1907-1916**
POTATOES.	Tons	Tons	Acres	Acres	Tons	Tons	Tons
England	3,142,323	2,370,095	473,342	399,586	6·64	5·93	6·22
Wales	197,672	134,421	34,645	28,362	5·71	4·74	5·36
Scotland	1,110,085	531,019	147,717	130,119	7·51	4·08	6·29
GREAT BRITAIN . .	4,450,080	3,035,535	655,704	558,067	6·79	5·44	6·19
Ireland	4,152,740	2,433,346	709,263	586,308	5·86	4·15	5·28
UNITED KINGDOM .	8,602,820	5,468,881	1,364,967	1,144,375	6·30	4·78	5·74
TURNIPS AND SWEDES.[5]							
England	11,413,928	12,147,635	918,313	879,684	12·43	13·81	13·07
Wales	749,701	837,753	50,818	52,682	14·75	15·90	15·43
Scotland . . .	8,053,180	5,896,871	414,305	414,320	19·44	14·23	16·41
GREAT BRITAIN . .	20,216,784	18,882,259	1,383,436	1,346,686	14·61	14·02	14·13
Ireland	4,624,834	4,435,911	293,452	262,814	15·76	16·88	17·33
UNITED KINGDOM . .	24,841,618	23,318,170	1,676,888	1,609,500	14·81	14·49	14·63
MANGOLD.[5]							
England	8,263,255	7,131,711	375,525	365,631	22·00	19·51	19·29
Wales	218,323	205,967	11,928	11,319	18·30	18·20	18·07
Scotland	52,699	44,240	2,415	2,347	21·82	18·85	19·22
GREAT BRITAIN . .	8,534,277	7,381,918	389,868	379,297	21·89	19·46	19·26
Ireland	1,834,164	1,627,834	93,074	80,434	19·71	20·24	19·88
UNITED KINGDOM . .	10,368,441	9,009,752	482,942	459,731	21·47	19·60	19·34
HAY *from* **CLOVER, SAINFOIN, &c.**					Cwt.	Cwt.	Cwt.
England . . .	2,184,070	2,647,113	1,504,255	1,581,615	29·04	33·47	29·97
Wales	231,398	251,691	177,644	181,084	24·93	27·80	25·76
Scotland . .	657,368	759,910	421,502	420,099	31·19	36·18	31·75
GREAT BRITAIN . .	3,062,836	3,658,714	2,103,401	2,182,798	29·11	33·52	29·99
Ireland	1,671,828	1,828,655	992,252	870,266	33·70	42·03	37·93
UNITED KINGDOM .	4,734,664	5,487,369	3,095,653	3,053,064	30·58	35·95	32·43
HAY *from* **PERMANENT GRASS.**							
England	4,623,735	5,325,150	4,246,066	4,270,042	21·78	24·94	23·55
Wales	525,802	613,636	548,147	555,946	19·18	22·08	20·26
Scotland	243,714	274,940	159,744	159,223	30·51	34·54	30·01
GREAT BRITAIN . .	5,393,251	6,213,726	4,953,957	4,985,211	21·80	24·93	23·40
Ireland	3,030,114	3,496,777	1,540,471	1,535,981	39·34	45·53	43·44
UNITED KINGDOM . .	8,423,365	9,710,503	6,494,428	6,521,192	25·96	29·78	28·13
HOPS.	Cwt.	Cwt.					
England[6]	220,719	307,856	16,946	31,352	13·02	9·82	9·50

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[4] Excluding a certain area returned as picked or cut green amounting to 28,037 acres in England and Wales in 1917.

[5] Excluding certain areas on which the crops were grown for the production of seed, amounting to 3,243 acres of turnips and swedes and 1,389 acres of mangold in England and Wales in 1917.

[6] No Hops are grown in any other part of the United Kingdom.

TABLE VII.—*Monthly Average Prices of* **Fat Stock** *and* **Milking Cows** *in England and Wales during the Year* 1917.

(Compiled from the Return of Market Prices published weekly by the Board of Agriculture and Fisheries)

DESCRIPTION.	Quality	Jan	Feb	Mar.	Apr	May	June	July	Aug.	Sept.	Oct	Nov.	Dec	Ye
FAT CATTLE		per stone s d	per stone s d	per stone s d	per stone s d.	per stone s. d	per stone s. d.	per stone s. d.	per stone s. d.	per stone s d.	per stone s d	per stone s. d.	per stone s. d.	pe sto s.
Polled Scots .	1	17 0	17 4	17 5	17 0	17 11	20 5	19 7	18 3	17 6	17 1	18 3	21 11	18
	2	15 6	16 0	16 4	16 3	16 11	18 3	18 3	17 8	16 9	16 4	17 6	20 3	17
Shorthorns	1	16 2	16 9	17 0	16 11	17 5	19 2	19 1	18 0	17 8	17 0	17 10	19 8	17
	2	14 9	15 5	15 9	15 8	16 2	17 9	17 5	16 5	16 0	15 6	16 4	18 2	16
Herefords .	1	16 4	16 7	16 9	16 9	17 2	19 6	18 11	17 8	17 1	6 10	17 8	19 8	17
	2	15 3	15 2	15 7	15 5	15 11	17 10	17 4	16 2	15 11	15 [illegible]	16 7	18 2	16
Devons .	1	16 0	16 5	16 9	17 1	17 3	18 6	18 9	18 0	17 6	17 2	17 9	19 4	17
	2	14 6	15 3	15 5	15 6	15 6	16 11	17 4	16 5	15 11	15 6	16 1	17 9	16
MILKING COWS: Shorthorns—		per head £ s.	per head £ s	per head £ s	per head £ s	per head £ s	per head £ s.	per head £ s	per head £ s.	per head £ s.	per head £ s.	per head £ s	per head £ s.	he £
In Milk .	1	41 10	42 6	41 18	41 18	42 16	44 10	44 0	44 9	45 5	46 19	50 11	55 14	45
	2	33 11	33 14	33 3	33 5	34 7	35 5	34 17	34 12	35 8	36 7	39 14	44 4	35 1
Calvers	1	38 11	39 14	38 12	40 1	40 16	41 8	40 19	42 5	42 8	43 11	46 17	49 15	42
	2	31 6	31 14	30 9	31 15	32 16	33 5	33 5	33 12	34 4	34 14	38 2	39 16	33 1
Other Breeds—														
In Milk .	1	41 12	42 10	43 1	43 1	39 9	43 19	40 17	44 11	41 1	45 11	51 8	54 12	44
	2	32 8	31 1	31 17	31 17	31 13	33 8	33 11	54 1	33 18	34 17	37 3	43 14	34
Calvers .	1	28 0	29 0	29 10	27 10	28 0	28 10	30 0	—	29 0	—	32 0	33 0	29
	2	26 0	27 10	27 0	26 0	25 10	26 10	27 0	—	25 0	27 0	28 0	30 0	26 1
		per lb. d.	per lb d	per lb d	per lb d.	per lb. d	per lb d.	per lb. d.	per lb. d	per lb. d.	per lb. d.	per lb. d.	per lb. d.	pe lb d
VEAL CALVES .	1	—	—	—	15¼	16¼	17¼	17	16	15⅛	15⅛	15¾	16⅛	1
	2	—	—	—	13⅛	14	15¼	15	14	14	13¾	14	14¾	14
FAT SHEEP:														
Downs . .	1	15	14⅛	15½	15⅛	17¾	18¼	17⅛	16¾	16⅛	16⅛	16⅝	17¾	1
	2	13¾	13¼	14	14¼	16⅛	16¾	16¼	15¼	15	14¾	15¼	16¼	1
Longwools	1	14	14	14¾	14¼	16⅛	17	16¼	15⅛	15½	15¼	15⅝	17¼	1
	2	13	12¾	13⅛	13¼	15¼	15⅝	15	14¼	14¼	14¼	14¾	16	14
Crossbreds .	1	14⅛	14⅝	15⅛	15⅝	18	18¼	17½	16¾	16¼	16	16⅛	17⅝	1
	2	13⅛	13⅛	14½	14¼	16⅛	16¼	15⅝	15	14⅛	14⅛	15	16¼	1
FAT PIGS:		per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	pe sto s.
Bacon Pigs .	1	13 9	14 11	15 10	16 1	16 0	16 0	16 9	17 4	18 0	19 4	18 10	[1]	16
	2	12 11	14 1	15 0	15 2	15 0	15 1	15 9	16 5	17 3	18 6	18 3	[1]	15
Porkers . .	1	14 8	15 8	16 6	16 8	16 5	16 7	17 3	17 7	18 5	20 1	19 3	[1]	17
	2	14 0	14 11	15 9	15 10	15 6	15 9	16 4	16 9	17 8	19 2	18 6	[1]	16

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[1] Prices not available at time of going to press.

TABLE VIII.—*Yearly Average Prices of* **Fat Stock** *and* **Milking Cows** *in England and Wales during the Years* 1908 *to* 1917.

(Compiled from the Weekly Return of Market Prices.)

DESCRIPTION.	Quality	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917
FAT CATTLE:		per stone *s. d*	per stone *s. d*	per stone *s. d*	per stone *s d*	per stone *s d*	per stone *s. d*	per stone *s d.*	per stone *s. d.*	per stone *s. d*	per stone *s d*
Polled Scots . .	1	8 2	8 5	8 9	8 5	9 3	9 3	9 4	11 10	13 11	18 3
	2	7 9	7 11	8 3	7 11	8 8	8 9	8 11	11 2	13 3	17 2
Shorthorns . .	1	7 11	8 2	8 7	8 2	9 0	9 0	9 2	11 9	13 8	17 9
	2	7 3	7 5	7 9	7 5	8 1	8 3	8 5	10 9	12 6	16 3
Herefords . .	1	8 1	8 5	8 9	8 5	9 2	9 3	9 3	11 10	13 9	17 7
	2	7 7	7 8	8 1	7 8	8 5	8 7	8 8	10 8	12 7	16 3
Devons . .	1	8 3	8 5	8 9	8 4	9 0	9 2	9 2	11 11	13 7	17 6
	2	7 6	7 9	7 11	7 7	8 1	8 3	8 5	10 10	12 1	16 0
MILKING COWS Shorthorns—		per head *£ s*	per head *£ s.*	per head *£ s*	per head *£ s.*	per head *£ s*	per head *£ s*	per head *£ s.*	per head *£ s.*	per head *£ s.*	per head *£ s.*
In Milk	1	21 5	21 7	22 3	22 2	22 1	23 15	23 13	26 6	34 5	45 3
	2	18 2	17 18	18 9	18 7	18 8	19 15	19 15	21 14	27 10	35 14
Calvers .	1	21 4	21 0	21 11	21 11	21 18	22 16	22 9	24 18	32 19	42 2
	2	18 2	17 16	18 5	18 0	18 2	19 4	18 19	20 15	26 13	33 15
Other Breeds—											
In Milk. .	1	19 1	18 13	19 12	19 2	19 2	20 16	21 0	24 4	31 8	44 6
	2	15 0	14 12	15 14	16 6	16 2	17 13	17 14	19 16	25 7	34 2
Calvers	1	14 8	14 11	16 1	14 12	16 9	16 9	17 4	19 0	24 1	29 9
	2	12 17	13 2	12 19	12 17	13 6	14 13	15 8	17 13	21 15	26 17
		per lb. *d.*	per lb. *d.*	per lb. *d.*	per lb *d.*	per lb. *d*	per lb *d.*	per lb *d.*	per lb. *d.*	per lb *d.*	per lb. *d.*
VEAL CALVES	1	8¼	8¼	8⅛	8⅛	8⅛	9⅛	9¼	10⅛	12¼	16
	2	7½	7⅛	7¾	7⅛	7⅛	8⅛	8⅛	9⅛	11	14¼
FAT SHEEP:											
Downs .	1	8⅛	7⅛	8¼	7¾	8¾	9¼	9¾	11	13¼	16⅛
	2	7⅛	6⅛	7½	7	8	8⅛	8¾	10	12	15
Longwools .	1	7¾	6¾	7¾	7½	8½	9	9¼	10½	12¼	15⅛
	2	7	6	6¾	6⅛	7⅛	8	8¼	9½	11¼	14¼
Crossbreds . .	1	8½	7½	8¼	7¾	8¾	9¼	9¾	11	13¼	16⅛
	2	7⅛	6¼	7⅛	7	7¾	8⅛	8¾	10	12	15
FAT PIGS:		per stone *s. d*	per stone *s. d.*	per stone *s. d.*	per stone *s. d.*	per stone *s. d.*	per stone *s. d*	per stone *s. d.*	per stone *s. d.*	per stone *s d*	per stone *s d.*
Bacon Pigs	1	6 2	7 1	7 10	6 8	7 4	8 5	7 10	9 7	12 4	16 7
	2	5 8	6 7	7 5	6 2	6 10	7 11	7 4	9 0	11 7	15 9
Porkers . . .	1	6 7	7 6	8 4	7 3	7 8	8 11	8 4	10 0	13 2	17 2
	2	6 2	7 0	7 10	6 9	7 2	8 4	7 11	9 6	12 6	16 5

[Continued from page 121]

May. The considerable rise which took place in June is presumably accounted for by heavy sales of kiln-dried barley which was excepted from the maximum price Order. In August the *Order dealing with the 1917 crops was issued and the maximum price of barley was reduced to the equivalent of 56s. per Imperial quarter. The average prices realised by farmers, however, ranged a few shillings higher, the new Order, though not excepting kiln-dried barley as such,* permitting an addition of about 5*s.* per quarter for barley sold for manufacturing purposes. The average price throughout the year 1917 came out at 64*s.* 9*d.*, an increase of 11*s.* 3*d.* over that of 1916, and 37*s.* 9*d.* over the average during 1909–13

Although the rapid rise in the price of **Oats** which had taken place in the closing months of 1916 was not continued in the early part of 1917, the average of 47*s.* 4*d.* at the end of December, 1916, was fully maintained, and in March, 1917, oats shared in the rapid rise which then took place in wheat and barley, and by the middle of April, when the maximum price order was issued, the price of oats had reached 59*s.* 8*d.* per quarter. This was the highest price ever recorded, and was 20*s.* above the maximum price during the Napoleonic War (39*s.* 4*d.*, in 1800), and 40*s.* 6*d.* above that prevailing before the present war. In rising to 59*s.* 8*d* the price of oats had more than trebled the average price in 1909–13, and thus had risen more in proportion during the war than either wheat or barley. The maximum price of oats of the 1916 crop was fixed on April 16 per Imperial quarter at 55*s.*, and prices consequently kept on that level until the August Order restricting the price of the 1917 crop to the equivalent of about 43*s* per Imperial quarter of 312 lbs. A slight rise occurred in December owing to an extra 1*s.* per quarter being allowed for delivery in that month. The average price for oats during the year 1917 was 49*s.* 10*d* , which was 16*s.* 5*d.* above the average of 1916, and 30*s* 9*d.* above the average of the five years preceding the war.

The septennial average of corn prices used for the calculation of *tithe-rent* charges for the current year (Table VI.) included nearly four years of war prices, and as a consequence the value per nominal 100*l.* tithe-rent based on the septennial average now stands at the very high figure of 109*l.* 3*s.* 11*d.*, which represents an increase of 17*l.* 2*s.* 11½*d.* on that during 1916, and 34*l.* 17*s.* 9*d.* (nearly 50 per cent.) on the average during 1910–14, and is the highest since 1879.

Live Stock.—(Tables VII. and VIII.). All classes of stock ready for the meat market fetched extremely high prices throughout 1917, and the record war prices of 1916 were in every case easily surpassed. Each of the four breeds of **Fat Cattle**, for which quotations are given, after opening in January at 1*s*. to 2*s*. per stone more than the high prices of the preceding December, continued to rise until June and July, after which a slight fall occurred until November, when prices again soared, and in December reached the highest figures ever known. Polled Scots, as usual, headed the list, the first quality attaining 21*s*. 7*d*. per stone, a price 12*s*. 4*d*. per stone above that of the corresponding month before the outbreak of war. The highest proportionate maximum was that realised by Polled Scots, which in December fetched 12*s*. per stone (135 per cent.) more than in the same month four years previously. The average prices of fat cattle for the year as a whole showed increases ranging from 3*s*. 8*d*. per stone for second quality Herefords to 4*s*. 4*d*. for first quality Polled Scots, the highest proportionate increase being in the second quality Devons, which fetched 32 per cent. more than in 1916. Compared with the average of the three years preceding the war, the increase ranged from 8*s*. per stone in the case of second quality Devons up to 9*s*. 3*d*. in that of first quality Polled Scots, the rough average of all classes of fat cattle showing an increase of 8*s*. 8*d*. (over 100 per cent.).

Milking Cows also opened at prices well above the high closing figures of 1916, and, similarly to fat cattle, after reaching a very high level in June and July, fell away slightly only to reach a still higher level in November and December. Shorthorns in milk fetched the remarkable price in December of 55*l*. 14*s*. per head, an advance of 30*l*. 5*s*. over the price of the corresponding month of 1913. Taking the average of 1917 as a whole, the increase ranged in the case of Shorthorns from 7*l*. 2*s*. per head for second grade calvers to 10*l*. 18*s*. for first grade cows in milk, and in the case of other breeds from 5*l*. 2*s*. for second grade calvers to 12*l*. 18*s*. (41 per cent.) for first grade cows in milk. The increases compared with the average prices during 1911–13 in the case of the first quality Shorthorns were 22*l*. 10*s*. per head (nearly 100 per cent.) for cows in milk, and 20*l*. 0*s*. 4*d*. per head (91 per cent.) for calvers; the approximate average increase for all classes of milking cows being 18*l*. per head (97 per cent.).

Owing to the restriction on the slaughter of calves imposed by the Maintenance of Live Stock Order no sales of **veal calves** were recorded in the first quarter of 1917. The restrictions were withdrawn on April 19, and when the quotations were resumed in that month prices of veal calves were well above those of 1916, and in June reached the highest figures on record, the average for first quality being over 17*d*. per lb. The June prices proved to be the maximum for the year, although prices in December were only very slightly lower. The average prices for the year showed a general increase of 3½*d*. per lb.

(30 per cent.) over those of 1916, and of *8d.* per lb. (50 per cent.) over those during 1911-13.

Fat Sheep prices in 1917 followed the same course as those of cattle, opening well above the prices of December, 1916, and reaching a particularly high level in June. In the case of Downs and Crossbreds, June prices were the maxima for the year, but in the case of Longwools a slight further advance occurred in December. The average increase for 1917 as a whole over 1916 was about *3d.* per lb., *i.e.* about 25 per cent. Compared with 1911-13 the largest increase was that of *7¾d.* per lb. (90 per cent.) for Downs, the average increase for all kinds of fat sheep being *7¼d.* (90 per cent.).

Prices of **Fat Pigs** increased proportionately as much as those of cattle and sheep, but the rise was more steady, and the maximum was reached in October[1], by which time each class of fat pigs was fetching about *7s.* per stone more than at the close of 1916. On the average for the year first quality bacon pigs showed an increase of *4s. 3d.* per stone and first quality porkers that of *4s.* per stone, over the average price of 1916. The increases compared with 1911-13 were, on the average of first and second qualities together, *9s. 5d.* per stone (180 per cent.) in the case of bacon pigs and *9s. 1d.* (120 per cent.) in that of porkers.

Wool.—The War Office having taken over the whole of the 1917 clip of British wool quotations of prices for that year are not available, and consequently the usual table is omitted from this paper. The prices paid by the War Office were 50 per cent. above those realised in 1914, when they averaged from *12½d.* per lb. for Leicester and Lincoln varieties to about *13¾d.* for Halfbred and *16d.* for Southdown.

IMPORTS OF AGRICULTURAL PRODUCE.

Owing to details of the imports of foodstuffs being withheld from publication under present circumstances the usual section of this article dealing with imports cannot be given this year. The Official Trade Returns for 1917 give no particulars of imports of foodstuffs other than the total value of grain and flour and of meat. The total value (as declared at the ports) of all grain and flour in 1917 was 174,893,000*l.* as compared with 133,253,000*l.* in 1916 and 83,262,000*l.* on the average of 1911-13. Imports of meat, including live animals for food, reached a total value in 1917 of 102,472,000*l.* against 94,050,000*l.* in 1916, and an average of 51,849,000*l.* per annum in 1911-13.

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[1] At the time of going to press particulars of the average prices realised in December were not available, and in any case the Order restricting the prices of live pigs would by then have come into play.

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March 1st, 1918.

THE WEATHER OF THE PAST AGRICULTURAL YEAR.

THE agricultural season of 1916-17 was marked at the outset by an extraordinarily long, cold and dreary winter, lasting, in effect, from the middle of November to the middle of the following April. Frosts of sufficient intensity to work havoc in gardens and shrubberies, and in some instances to prove disastrous even to animal life, were experienced from time to time, the sharpest of all occurring during the opening week of February and March, and also of April. At a season of the year when vegetation should have been showing signs of active growth the land remained in the iron grip of winter, and in the early part of April all farm crops were in an abnormally backward state. Soon after the middle of that month, however, a radical change in the weather took place, and in the course of a very few weeks the aspect of the country was as advanced as in any ordinary season. The rapid and uninterrupted growth of vegetation appears to have been due not only to a succession of genial sunny days, but to the rarity of cold nights and to an almost entire absence of the sharp spring frosts which so often exercise a more or less devastating effect in gardens and orchards, and even among the tenderer farm crops. The propitious weather of the late spring continued throughout the opening weeks of the summer, but a steady deterioration afterwards set in, the conditions becoming at first changeable and thundery, and, in August, unusually cool and wet. The agricultural prospects, which were at one time as favourable as one could wish, became therefore much less so as the season advanced, and the cereal harvest, which was conducted under adverse conditions, proved in the end only moderately good. In addition to the abnormally low temperatures which characterised the earlier months, the year was distinguished by an unusual amount of thundery weather and by some phenomenally heavy falls of rain. A further reference to these will be found later on in our review of the summer and autumn seasons.

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THE SPRING OF 1917.

The arrival of spring, which should have taken place, according to the meteorologist, about the beginning of March, and, according to the astronomer, some three weeks later, was delayed in 1917 until after the middle of April. The earlier half of the season was marked by an almost persistent run of cold weather and by frequent falls of snow, the result being seen in a most effective check in the growth of vegetation. The genial weather which set in at so late a period soon made amends for all that had passed, and by the close of May the crops, which had at one time been so terribly backward, were as advanced as in any ordinary season. One of the most remarkable features in the history of the year was the almost entire absence of the May frosts which so often cause serious and in some cases widespread damage in the gardens and orchards. In 1917 the spring, when it once set in, was practically free from any such disastrous influences, the growth of vegetation proceeding without a break, and, according to many reports, with unexampled rapidity.

March proved an unusually cold month, the only indication of the advance of the season occurring about the 16th and 17th, when a brief touch of warmth resulted, in a few isolated places, in the registration of shade temperatures as high as 60°. The coldest weather was experienced between the 6th and the 10th, the thermometer on the night of the 8th falling to 15° or less in many parts of Great Britain and reaching a minimum of 8° at Alnwick Castle, Bellingham, Hoylake and Hereford. At several places in the inland parts of Scotland the readings in the screen were a degree or two below zero. Snow showers were reported during the first week in many northern and eastern districts, and more decided falls of snow over a wide area between the 19th and 21st and between the 28th and 31st. Heavy rains occurred also in Ireland on the 3rd and 4th, and in Wales and the west and north of England on the 10th and 11th, the falls in some parts of Devonshire amounting on the latter occasion to between 1¼ and 1½ inch. Thunderstorms were experienced in Cornwall on March 5, in the south-west of England on the 10th and 11th, and, locally, in many parts of the country on the 29th and 30th.

In April there was for a long time no indication whatever of any improvement in the weather, the month being, upon the whole, the coldest April experienced for at least fifty years past. The frosts experienced at the beginning of the month were a trifle sharper than those of March, the sheltered thermometer falling on the night of the 1st to a minimum of 5° at Newton Rigg, in Cumberland, 6° at Garforth, and 7°

at Rounton and Hodsock Priory (Worksop). During the earlier half of the month snow was frequent, and in the north it was sometimes very heavy. For the locality the most remarkable storm was that which visited the west and south of Ireland on the 1st. On our extreme western seaboard such occurrences are very rare, and at Blacksod Point, in co. Mayo, no living inhabitant had previously witnessed such a scene as awaited him on April 1, when the roads were blocked by snowdrifts varying from eight to ten feet in depth. April, 1917, proved an exceedingly anxious time to flockmasters, more particularly in the north, and in some districts the loss of sheep and lambs was reported as very serious. After about the middle of the month, however, the long delayed spring at length made its appearance. Between the 19th and 22nd shade temperatures slightly above 60° were recorded in many districts, while on the 29th or 30th the thermometer rose even higher and touched 67° in London (at Camden Square). The improvement in the weather was accompanied by a marked absence of rain, no appreciable quantity being experienced over a period of twenty-one to twenty-seven days, lasting from the middle of April until very nearly the middle of May.

May was, upon the whole, sunny and genial, but the atmosphere was seldom in a really settled state, and in the latter half of the month thunderstorms were unusually frequent for the time of year. In many instances the storms were accompanied by very heavy downpours of rain. At Liphook (Hants) on the 29th there was in the short space of half an hour as much as 1·1 in. of rain and a tremendous fall of hail, accumulating in places to a depth of two feet and remaining unmelted for three days. Temperature, though mostly above the average, showed considerable fluctuations. On or about the 4th the thermometer rose above 70° and round the 13th it touched or slightly exceeded 75°. The warmest weather occurred between the 26th and 28th, when the shade readings were above 75° in many places, and as high as 81° at New Malden and 84° at Camden Square. Between the 6th and 10th, and round the 16th, many of the midday readings were below 50°, and at Ushaw (Durham) the thermometer on that day did not exceed 44°. The only frost of any noteworthy severity occurred on the 7th, when the thermometer fell to 25° or less at many of the northern and central stations, and reached 17° at Garforth.

The warmth of May afforded a poor set-off to the cold of March and April, and for the whole spring the mean temperature was considerably below the average, the deficiency being greatest over the south-eastern quarter of England. Rainfall was in excess of the normal, but in the eastern and north-eastern counties the excess was small. The total duration of bright sunshine did not differ very much from the average excepting in the south-western district, where there was an excess, amounting for the whole season to as much as half an hour per day.

THE SUMMER OF 1917.

Viewed from the standpoint either of the agriculturist or of the mere holiday maker the summer of 1917 could scarcely be regarded as a brilliant success. In June and the earlier half of July many districts experienced a few substantial spells of sunshine and warmth, but the conditions were seldom quite settled, and few places escaped without an occasional thunderstorm and a heavy fall of rain or hail. Towards the end of July the weather broke up entirely, and in August it was practically as bad as in 1912, hitherto one of the worst Augusts on record. The progress of the harvest was therefore seriously delayed, the pastures suffered from an excess of moisture, and in the orchards and hop gardens a considerable amount of damage was occasioned by the high winds which occurred at frequent intervals. In one respect the summer of 1917 was distinguished above all its fellows On June 16, during a severe thunderstorm, the western parts of London experienced a fall of rain and hail such as had never before been registered in the Metropolis; while nearly a fortnight later, on the 28th, Bruton, in South-East Somerset, experienced a downpour such as had never before been recorded in one day, even in the wettest portions of the United Kingdom It is scarcely necessary to remark that in the latter district serious floods were occasioned, the roads being torn up to such an extent that they resembled "the bed of a mountain torrent or a glacier moraine."

Notwithstanding the very striking events just noticed the weather in June was often very fine, cold at first, but warmer as time progressed. Over England the hottest day of the month, and also of the year, was the 17th, when the thermometer in the shade rose to between 85° and 90° in many places, to 92° at New Malden, and to 93° at Reading and at Little Massingham, in Norfolk. After about the 20th a gradual but steady reduction in warmth took place, and by the end of the month the weather had become almost as cool as it was at the beginning. The conditions were also very changeable, and thunderstorms occurred from time to time in nearly all districts. During the storm of the 16th, to which allusion has already been made, the rainfall in West London amounted to 4·0 in. at Holland House and to nearly 4·7 in. at Campden Hill, both in Kensington. In the south-eastern parts of the

Metropolis the fall at the same time was inappreciable. On the following day an exceedingly heavy hailstorm occurred at Tenbury in Worcestershire, some of the stones being from 5 to 6 in. in circumference. The hail lay about in heaps until the next morning, and in the neighbourhood much damage was done to fruit trees and vegetables. The Somerset cloudburst of June 28 formed part of a heavy rainfall which affected practically the whole of southern England, amounts exceeding 1 in. being recorded in most places. Over a considerable portion of East Somerset and West Wilts the fall amounted to between 5 and 7 in., at one station in Bruton to 8·5 in., and at another in the same town to no less than 9·8 in. The largest daily amount previously recorded in any part of the United Kingdom was on October 11, 1916, when 8·2 in. was measured at Kinlochquoich, in Inverness-shire. This fall in one of the wettest districts, was therefore exceeded in Bruton to the extent of more than an inch and a half, in itself quite a large quantity for any rainfall day in the south of England!

Cool unsettled weather continued to prevail throughout the early part of July, thunderstorms being experienced over our southern and south-western counties on the 3rd and the 7th and 8th, and in many districts between the 13th and 15th. On the 14th a heavy hailstorm occasioned much damage to crops in the neighbourhood of Norwich. On the 4th and 8th the thermometer at some places in the south of England did not reach 60°, but later on the weather became much warmer, and on the 13th and 14th shade temperatures above 80° were experienced rather generally, the thermometer touching 86° at Southend and 84° in a few other parts of our eastern counties. Between the 15th and 21st the air again became cool, but on the 22nd and 23rd and again on the 27th shade temperatures exceeding 80° were recorded. The close of the month proved almost as unsettled as the close of June, and on the 30th a heavy fall of rain occurred in the south-east of England, as much as 2·1 in. at Wokingham and 2·3 in. at Isleworth.

In August the weather was irremediably bad, dull and often very windy, usually more or less rainy, and not infrequently thundery. The nights were exceptionally mild, but the cloud canopy which checked the progress of terrestrial radiation resulted also in an absence of normal midday warmth, scarcely any part of England recording a shade temperature as high as 80°. After the first week there were in fact very few places which experienced a midday reading much above 70°. A heavy fall of rain occurred in the south and east on the 1st, more than 1 in. in many localities, and between 1½ and 2 in. in portions of Kent, Surrey and Sussex. Other heavy falls, mostly in the northern counties, were reported between the 8th and 13th, and again on the 16th and 17th; for the two days last mentioned the aggregate amounted to as much as 2·7 in. at Lancaster, 2·8 in. at Morecambe, and 4·2 in. at Beddgelert. On the 27th the western districts were chiefly affected, 2·2 in. of rain being measured at Princetown and 3·0 in. at Beddgelert.

For the summer as a whole the mean temperature was above the average, the excess being slight in the southern districts but rather considerable in the east and north-east. Rainfall was largely in excess of the normal, especially in the south-east of England, where the amount was greater than in any summer of the previous twenty years; in other districts the season was less rainy than in 1912. The total duration of bright sunshine did not differ very much from the average In the eastern and north-eastern counties the agreement was almost absolute, but in most other districts there was a slight deficiency.

THE AUTUMN OF 1917.

The summer which began so well but ended so indifferently was followed by an autumn in which fair dry weather predominated in all but the most northern parts of the country. The harvest which had in many districts been so seriously delayed by the frequent rains of August was therefore secured under favourable conditions, and the dry weather which set in at first in the south, and later on in the midland and northern counties, enabled the farmer to prepare the land for the forthcoming season. In October there were frequent rains and occasional falls of snow, but throughout nearly the whole season the weather was unusually windy, a factor which assisted in some measure in the drying of the land, the eastern and southern districts being in this respect more fortunate than the western and northern. By the close of the autumn the agricultural outlook over the country generally was regarded as favourable, if not distinctly promising.

September was, upon the whole, a dry and windy month, seldom very warm in the daytime, but mild at night, frost being rare and usually of very little severity. The warmest weather occurred between the 4th and 7th, when the shade temperature rose to 75° and upwards in many parts of England and touched 78° on the 5th at Ardingly, in Sussex. Thunderstorms occurred in many districts on the 1st, with heavy rain in the north of England, as much as 1·1 in. at Bellingham and 1·2 in. at Scarborough, the southern counties being similarly affected on the night of the 5th. On the 13th a heavy downpour was experienced over the northern parts of England and Wales and on the 18th over the midland and southern districts, the fall on the latter occasion amounting to 1·8 in. at Ilfracombe and 2 in. at Newchurch (Mon.). During the closing part of the month the weather over England was mostly fair and dry, and on or about the 25th the thermometer rose to a high level for the season, readings above 70° being recorded in many places; at Southend on the 25th the thermometer touched 78°.

October opened with another short burst of fair warm weather, the thermometer rising between the 1st and 3rd to 70° or more in several parts of England and reaching 75° at Southend. For the remainder of the month the air was cool and the general conditions very unsettled, with thunderstorms in many places between the 6th and 8th, the 11th and 15th, and again on the 23rd. Over an inch of rain fell in a number of isolated localities on the 3rd or 4th and on the 16th, the amount on the latter occasion being over 2 in. at Creech Grange, on the Purbeck Hills. The month was windy throughout, and more especially on the 24th and 25th, when a severe gale from West and North-West was experienced in all districts. At Aberdeen the wind reached, in gusts, a velocity of 83 miles per hour, at Howden (East Yorks) and Southport 87 miles, and at Eskdalemuir, in Dumfriesshire, 90 miles. After the passage of this storm the weather turned very cold, and snow fell rather generally, some observers in the southern counties remarking that the date was the earliest upon which snow had been seen in their immediate vicinity. Between the 25th and 28th the thermometer in some places remained below 40° all day and sharp frosts occurred at night, the thermometer at Wokingham falling early on the 28th to a minimum of 20°. During another gale which visited the country on the 29th a heavy fall of rain was experienced in South Wales and the south-west of England, as much as 1·5 in. at Lampeter and 1·9 in. at Princetown, on Dartmoor.

November was upon the whole a dull windy month, but dry in most parts of England. In Scotland, and more especially in the western districts, it was extremely wet, the total rainfall at Rothesay being the largest recorded in November for at least 100 years. The days were often rather cool but the nights were almost invariably mild, no frost worthy of mention being observed until very nearly the end of the month. A stiff gale from west and north-west occurred, as in October, on the 24th and 25th, and on the 26th a heavy fall of rain (accompanied in many places by snow or hail) was experienced over England. More than an inch of rain was measured in some parts of Lancashire, and as much as 1·8 in. at Stonyhurst. The falls in these districts were, however, trivial in comparison with those which occurred about the same time in Western Scotland. On

Loch Awe rain fell almost continuously from the morning of the 26th to the evening of the 30th, and at Kinlochquoich, in Inverness-shire, the total amount for the same five days was no less than 17 in, about two-thirds of the average quantity which falls in London in the course of a whole year.

For the autumn as a whole the mean temperature was above the average, the excess being greatest in the midland and north-eastern counties. The amount of rain varied considerably in different localities. In the north-west of England it was in excess of the normal, but in most other districts there was a deficiency; in the north-east less than two-thirds of the average amount was collected. Bright sunshine was very deficient in the western districts but in excess of the average further east. Between these two regions, *i.e.*, in the midlands, it agreed very closely with the normal.

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NOTES, COMMUNICATIONS, AND REVIEWS.

The Agricultural Wages Board.—The subject of a minimum wage for farm workers was debated in the House of Commons at the time of the revolutionary wars in the eighteenth century, and Bills to provide for such a wage were introduced in the House of Commons. The debates were good, but the Bills failed to pass through the House. The Poor Law institutions of the time were of an elastic character, and in some parts of England a system of minimum support for men with families, and sometimes single men, was established when distress began to produce symptoms of strong discontent; and was continued more or less up to 1834. The reform of the Poor Law in that year re-established agricultural wages on a purely commercial basis. In some instances the reform itself caused dislocation and distress, but it did at least tend to remove the system of supporting agricultural labour out of local public funds and did something to secure that the wages of labour should be sufficient to support the family of the labourer. A good deal of immediate relief from the pressing conditions of the labourer was afforded by the effects of the Repeal of the Corn Laws, whatever may have been the indirect effects of this measure on the condition of the labourer through its effect on the prices of the farmer's produce. Another step was taken to improve the lot of the farm worker by the organisation of agricultural trade unions in the 'seventies and 'eighties of the last century; but although the movement scored initial successes it was doomed to eventual failure. A few branches continued to exist until the beginning of the present century, and a revival occurred about 1907. By 1912 the union had a considerable following in a few areas, and signs of industrial action became evident. About the same time the subject of a minimum wage for farm workers was again raised in economic circles and periodicals, and soon afterwards it was debated on public platforms. After about a year of war the public was impressed by the weight of evidence and influence of reports of various official and other committees with the necessity of providing some form of guarantee for prices of corn, and, concurrently with the pressure of those concerned for such a measure, the need for some form of guarantee of wages for the farm worker was pressed forward. The Corn Production Act of 1917 was the common result of public pressure on the Government regarding both prices of corn and wages of labour.

The chief provisions of the Act, as regards wages of workmen, deal with able-bodied workmen, and are—

(*a*) That an Agricultural Wages Board shall be established.

(*b*) That the Agricultural Wages Board shall fix a minimum rate (or minimum rates) of wages, and may cancel or vary any rate fixed by them.

(*c*) That the Agricultural Wages Board, when fixing minimum rates for time work, shal secure for the able-bodied workman wages which in their opinion are equivalent to wages for an ordinary day's work at the rate of at least 25s a week.

(*d*) That the Agricultural Wages Board shall, so far as practicable, secure for able-bodied men wages which, in the opinion of the Board. are adequate to promote efficiency and to enable a man in an ordinary case to maintain himself and his family in accordance with a reasonable standard of comfort.

The institution of the Wages Board is partly regulated by the first schedule of the Act, and partly by regulations made by the Board of Agriculture. This schedule also provides that district wages committees may be established, and subsequent regulations issued by the Board of Agriculture requires that they shall be established by the Wages Board.

By regulations made by the Board of Agriculture the Wages Board consists of thirty-nine members, seven of whom are "appointed" members, and thirty-two representative members, sixteen representing each class of employers and employees respectively. The "appointed" members, whose appointment rests with the Board of Agriculture, are persons with an impartial interest in the subjects to be dealt with by the Wages Board. Of the sixteen representatives of employers two are elected by the Royal Agricultural Society, two by the Executive Committee of the National Farmers' Union, two by the Council of the Central Chamber of Agriculture, and two by the Welsh Agricultural Council. Eight other representatives of employers are nominated by the Board of Agriculture after consideration of names submitted by agricultural associations. Of the sixteen representatives of employees eight are elected by trade unions, six by the Executive of the National Agricultural Labourers' Union, and two by the Executive Committee of the Workers' Union. The remaining eight representatives of employees are nominated by the Board of Agriculture, in consultation with the Ministry of Labour, after consideration of names submitted by workmen and their representatives.

A certain amount of disappointment and chagrin has been felt in some areas, especially by farmers' organisations, that no representative member was chosen from their area; but with the limited number of representative members it was impossible that every county should be represented. It appears that some geographical areas have received more than their share of representation, from the side of both employers and employed. In the case of employees' representatives this was largely due to the comparatively organised condition of the farm workers in the eastern counties. In the case of employers choice was limited to some extent by the fact that few men of this class have shown an interest in the labour problem on broad social lines. However, if sufficient interest is displayed in the work of the Wages Board, and individuals with good qualification for representative seats on the Board are forthcoming, this defect can be remedied when the time arrives for future nominations. Even at present, it may be said that there is surprisingly little criticism of the *personnel* of the Wages Board The difficult task of forming the Board was pursued with much candour and tact.

By Order of the Board ot Agriculture and Fisheries the Agricultural Wages Board is required to establish District Wages Committees for the whole area of England and Wales, such committees to act for areas determined by the Agricultural Wages Board. The areas for which the district committees will act have been determined by the Board, the general principle being that the geographical county shall constitute the area in England. However, certain exceptions have been made. Northumberland and Durham constitute one area; the Furness district of Lancashire has been included with Cumberland and Westmorland; Rutland has been included with Leicester; Huntingdon and Bedford with Cambridge; London and Middlesex with Hertford. In Wales each district area covers two or more counties. In all there will be thirty-nine district committees, thirty-three of which will be established in England.

District committees consist of "appointed" and "representative" members. The size of the committees varies to some extent with the size and character of the area for which they will act. The number of "appointed" members varies from four to seven, and the number of "representative" members from six to twelve for each "side," or a total of twelve to twenty-four. In each case at least one member of a district committee must be a woman.

The chief duty of the District Wages Committees will be to consider and recommend to the Wages Board minimum rates of wages applicable to the areas for which they act; and no rates of wages can be fixed, varied, or cancelled, with effect of law, until a district committee has had an opportunity to report thereon to the Wages Board. This is provided by the first Schedule of the Act. In addition to the duties and rights of the district committees laid down in the Act, other powers can be conferred and duties delegated by the Agricultural Wages Board. Powers of hearing complaints, and granting permits of exemption (*e.g.* in respect of non-able-bodied men), have, with certain reservations, already been delegated to district committees; and district committees are authorised to delegate these powers to sub-committees.

Up to the time of writing the chief occupation of the Wages Board has been the establishment of district committees; but in March several committees were established, and were proceeding to consider and recommend rates of wages and conditions of employment applicable to their respective areas. Early in the course of work of the Wages Board it was apparent that the existence of varied and sometimes little known conditions of employment in the farming industry would present many difficulties to a central authority in the determination of wages and conditions of employment. For the information of the Wages Board an investigation into conditions of employment in the farming industry was instituted by the Board of Agriculture. As a result of this investigation, and the preliminary work of the district committees, it is hoped that the Wages Board will be fully provided with the information on which its decisions must be based if they are to be of a fair and practical character.

However, with the best and most detailed information at their disposal, the Board will encounter many intricate and difficult situations. The principles of the valuation of allowances in kind or perquisites, the treatment of the cottage rent in cases in which cottages are provided by employers, and, it may be, the regulation of hours of labour in relation to the wages of any class of workmen, call for careful consideration. And should the Wages Board attempt to follow in detail the instruction of the Act that wages shall be adequate to promote efficiency, and to enable the labourer to maintain himself and his family in accordance with a reasonable standard of comfort, many difficulties of interpretation and assessment will arise. Indeed the question as to how much "the industry can bear" has already presented itself for answer.

It is probable that one of the results of the actions of the Wages Board will be to simplify and standardise conditions of employment in agriculture; and within certain limits this is highly desirable. To go further than this in the estimation of the effects of the regulation of conditions of employment by a legal tribunal entails more than the ordinary risks of prophecy But it may perhaps be said that such regulation, which is the work of representatives of both parties to the contract of employment, and of other persons with wide knowledge of farming and interests in its welfare, ought not to be the cause of fear and trembling.

A. W. ASHBY.

The Present Position of the Bee-Keeping Industry.—Bee-keeping in this country, owing to climatic conditions, is an occupation which can be and is followed by a large number of people on a small scale, and not by a few individuals as a large commercial enterprise. The industry has suffered very severely during the last few years, owing to the ravages made by disease on the stocks of bees in the country. However, the outlook for the future of the industry is not so gloomy as might at first sight appear.

The scourge of Foul Brood some years ago had the same discouraging effect on some people as the Isle of Wight disease has to-day. Foul Brood has been tackled and mastered, and is no longer to be feared. Remedial measures can be taken at once by means of a drug cure, which is easily applied, and if the treatment is properly carried out the disease quickly disappears. A few years ago the papers devoted to apiculture were filled with wailings on account of this disease. To-day one scarcely sees it mentioned, and when it is its advent can invariably be traced to carelessness among bee-keepers.

With regard to the "Isle of Wight" disease the situation is not quite so satisfactory, and there are many people to-day who either refuse to commence bee-keeping, or who are uncertain whether to do so or not, in consequence of it. Sensational statements in the daily papers are not conducive to their encouragement.

There is no need here to go into the history of the disease. It is sufficient to say that it is an epidemic which will eventually disappear. It was known in Holland some seventy years ago, when it caused severe loss to bee life. America, Australia, Germany, and France, are also sufferers Owing to the fact that we had no previous knowledge of it, the first onslaught here was most alarming. In some districts whole apiaries were wiped out, especially in Hampshire, Middlesex, Surrey, Berkshire, and Kent, but the situation to-day is much brighter. Although there is yet much to learn, a great deal is known about the disease. Many remedies have been tried, and under certain conditions some of them cure the disease. Among the remedies that have been more or less successful are izal, bactoral, and dioxygen, and at the present time the flavines are being tested.

In many instances bee-keepers who had previously lost the whole of their stocks have recommenced, and have once more flourishing apiaries, and bee-keeping associations are doing their best to restock devastated areas by carrying out a re-stocking scheme. The idea was initiated in Kent, a county which had suffered badly from the disease, and during the past two years many hundreds of nuclei have been distributed among the members for the small sum of ten shillings each. The scheme is self-supporting. Some members lend empty hives, in which the nuclei are made, others give one or two stocks from which the nuclei are made and queens reared. These nuclei are supplied only to those who have lost all their bees It is interesting to know that out of all the nuclei distributed, which have gone into hives in apiaries previously wiped out by Isle of Wight disease, not a single case of disease has been reported. In many cases not only did the nuclei firmly establish themselves, but gave a good crop of surplus honey as well. The scheme has been such a success that it has been adopted in Leicestershire, Nottinghamshire, Herefordshire, and Sheffield.

Much has been written with regard to "immune bees." Let me state here that there is no such thing. Some races are more resistant than others, but it is possible for any variety or cross to be attacked. Dutch bees have been boomed as immune, yet I know of one apiary in which seventy stocks of pure Dutch bees died last winter from the disease. They are certainly more resistant than many varieties, but this advantage is outweighed by their disposition to swarm. The variety of bees which has been found to succeed the best in the face of disease is the Italian hybrid. These can easily be obtained by importing queens from Italy, and allowing their progeny to be mated to our native drones. Hundreds of Italian queens were imported into this country last summer, and the benefit of this will be greatly felt during the coming season.

Bee-keeping should be taken up vigorously during the present food shortage. Honey can be used in every case where sugar is usually employed, even to jam making. It replaces glycerine, so urgently needed for munitions; it saves butter and margarine. There are plenty of second-hand bee-hives to be had, or new ones can be made at home from boxes and other waste wood. If the honey is sold instead of being used in the home, it now realises 2*s*. per lb. when extracted, and up to 3*s*. 6*d*. per section when sold in the comb, thus showing a handsome profit on the outlay.

Considering the present position generally, the outlook for the industry is most promising. At the same time bee-keepers have a legitimate grievance against the Administration for its almost complete indifference to their difficulties. No encouragement has been given to them, no research work of any importance has been initiated or financed, and nothing has been attempted to combat disease upon lines that have been so successful in dealing with animal and plant diseases. The Board of Agriculture would do well to reconsider the steps which it might take even at this late hour, to foster this important minor agricultural industry, and for a start it might do well to examine what action the Governments of other States have taken, for it could learn much from them.

W. HERROD-HEMPSALL, F.E.S.

The Agriculture of Oxfordshire and Berkshire. Agriculture in Oxfordshire: a Survey made on behalf of the Institute for Research in Agricultural Economics, University of Oxford. John Orr. (Oxford, Clarendon Press, pp. ix. + 239, 8*s*. 6*d*. net) **Agriculture in Berkshire: a Survey made on behalf of the Institute for Research in Agricultural Economics, University of Oxford.** John Orr. (Oxford, Clarendon Press, pp. viii. + 208, 8*s*. 6*d*. net.)

The recently founded Institute of Agricultural Economics very wisely began its work by making a survey of the agricultural conditions in the country round about it, and in these volumes Mr. Orr has summarised his impressions, and given a general account of the farming of Oxfordshire and Berkshire. The two counties work very well together; geologically the soils range in regular sequence from the Eocene sands and clays of recent formation down to the Lias clay of the much older Jurassic times.

Broadly speaking, the geological formations run in belts across the counties from east to west, the newest occurring in the south of Berkshire; the successive bands take on a more north-easterly and south-westerly direction, as one goes to the north of Oxfordshire. Further, the clays being soft, and easily weathered, have tended to form broad valleys, while the chalk and limestone formations form upland and hill country. Thus there arises a series of hills and valleys running in the direction of the formations. They are, however, cut through from north to south by the Cherwell and the Thames.

Starting in the south of Berkshire, the Eocene sands and clays, the newest of the whole series, form a belt south of the Great Western Railway from Maidenhead to Reading and beyond, constituting the Vale of the Kennet. On the whole it is not a great agricultural region.

There is a certain amount of dairying, fruit, some general farming, much residential land, and some waste. North of this comes the chalk, the eastern part of which, the Chiltern Hills, is in Oxfordshire, and the western part, the White Horse Hill, is in Berkshire. The two portions are divided by the Thames, which, however, has not cut through to the lower formations. As elsewhere the chalk is largely an arable region, the special features of which are described in some detail. The farms are large, running from 600 to 1,000 acres, and contain high and low lying land worked in conjunction, the vale land helping to farm the down land. Both in Berkshire and in Oxfordshire the surface is often covered with gravel and clay-with-flints, and in places there is not much chalk visible; indeed much of the land badly needs chalking. Dairying for Reading is now coming in, but where the farms are too far out for this system, corn, sheep, and heifers are produced.

Passing further north we come to a belt of Upper Greensand and Gault, running somewhat to the north-east and south-west. The Gault adjoins the Kimeridge Clay (the Weald and Purbeck beds being absent, and the Portland beds occurring only in Oxfordshire).

These two clays form in Berkshire the Vale of White Horse, and produce good grazing pastures, though a great deal of the land is under the plough in spite of its heaviness. Some of it is badly farmed, but Mr. Orr considers on the whole that it contains greater possibilities of development than any district of Berkshire. The Upper Greensand is heavy, and, as in Surrey and Sussex, is famous for its wheat-growing qualities. From Wantage to Hagbourne and Wallingford some of it is now going into fruit. The western part of the Vale used to produce a great deal of cheese, but this industry is now dying out.

Further north comes the Corallian formation, a ridge of light stony soil and arable farming, rising from the White Horse Vale, and overlooking another and broader valley still further north. This, the Thames Valley, occupies a broad belt of Oxford Clay, a cold, heavy, yellow soil, mainly poor grass, which could be improved by slag and drainage. On the Berkshire side some of it is shockingly badly farmed. Mr. Orr calls it "a blot on the countryside." From Littleworth almost to Oxford it has been allowed to get out of hand almost without a break. On the Oxford side it is covered in its higher parts, *e.g.* at Freeland, with plateau gravel, and in places elsewhere with river gravel. In such cases arable and sheep farming occur. Indeed it is typical of Oxfordshire that although much of the subsoil is clay the surface deposits tend to lighten it, so that the county as a whole is largely arable: 48 per cent. of its cultivated areas is under the plough, and 29 per cent is in corn.

To the north of the Oxford Clay, and starting from the line Broughton Poggs, Witney, Woodstock, Bicester, Goddington, and now definitely trending south-west to north-east, comes the undulating upland country formed by the Cornbrash, and further north the Great Oolite. The soil here is variable. Arthur Young calls it all stone brash. It is generally a loose, dry loam, but some is heavy and sour, as for example, Wychwood. West of Chipping Norton is a sandy brash, where crops will not finish. The lighter land on which Woodstock stands is used for corn and sheep; potatoes do well here also.

Still further north this gives place to the Middle Lias, forming a rich brown on red loam, underlain in places by iron ore, that is largely worked by surface quarrying and finally a patch of Lower Lias. This region is mostly above the 400 ft. contour, and it includes some of the best soils in the county, responding better than those of the Oolite to good farming. There is much mixed farming with corn and sheep, not much potato growing, and no very good markets.

Taking the county of Oxford as a whole, the cultivation is extensive rather than intensive. More than 40 per cent. of the farms exceed 300 acres in area, and there are only just over 2,000 farmers and graziers to over 411,000 acres of cultivated land.

Reverting to Berkshire, two sad features brought out by Mr. Orr are the decline in the number of pigs from nearly 50,000 in 1867 and 1872 to only a little over 20,000 in 1914; and worse still, the heavy drop in the number of sheep from over 354,000 in 1868 to 121,000 in 1914. Several causes are given as operative. The introduction of the Wyfield system is one. This deserves more space than it receives, because it is succeeding, and because it produces more corn than the older plan. It is a six-course scheme, corn being grown every second year alternately with roots, clover, and then bare fallow. It involves considerable reductions in the flocks, the hay and straw being sold off; but it is essentially a large farmer's scheme, employing only one man per 100 acres.

Berkshire has always been noted for agricultural experiments. It was here that Tull worked, and the author has been over his farm, but failed to confirm the low estimate in which the writers have held it. Another recent experiment to which brief reference is made is the Wantage farm, where intensive methods are being applied.

Both volumes contain chapters on soils, crops, farm and estate management; and the statistics are plotted in diagram form so as to show their trend. There is also an interesting set of illustrations, which have been very well reproduced. Each volume is provided with a geological map, but unfortunately the colour schemes do not quite tally, so that direct comparison is made rather difficult, and moreover, the map has not been used as much as it might in the writing up of the survey. Oxfordshire is also provided with an orographical map, but not so Berkshire. Author and publishers alike can be congratulated on the two volumes, which will be found very useful to students and farmers, and will lead them to ask for more information about some of the interesting systems of farming to be found therein.

E. J. RUSSELL.

British Forestry.—E. P. Stebbing (London: John Murray, price 6*s.*). In this volume Mr. Stebbing, of the Forestry Department, University of Edinburgh, writing for the most part in the second year of war, reviews the position of forestry and of timber supplies from the national standpoint. He reminds his readers that afforestation in its various aspects has, during the past thirty years, received a large amount of attention from Government committees and commissions whose reports have, however, failed to stimulate effective State action. Since Mr. Stebbing's volume appeared another Government committee has reported, and a strong case is made out for vigorous action in the direction of State afforestation, and of private activity stimulated by public support. Whether results commensurate with the recommendations will emerge it is hard to say, for if nothing was done in times of peace, when money was plentiful, energetic action at the present time would appear to be still less likely.

Mr. Stebbing pleads for a large extension of afforestation on land that he describes as derelict, but which is for the most part utilised by stock, and is included in the area that is classed in the Board of Agriculture Returns as "rough mountain and heath land used for grazing." He would also like to see the present woodlands improved partly by private effort and partly by means of Government assistance. It is pointed out that whereas average forest land in this country should produce annually about sixty cubic feet of timber per acre, the returns from our existing woodlands are hardly better than one-sixth of this amount. This result is due to the fact that, broadly speaking, our British woodlands are greatly understocked. The trees stand too far apart, and thus a full annual increment of timber cannot be looked for. This unsatisfactory condition of things has been brought about by various causes. The inclinations of foresters and landowners have been in the direction of encouraging the growth of the individual trees, rather than the aggregate growth of the wood as a whole. Not only does such a system of management produce a low acreage return but it also results in the production of timber of low quality. This has been recognised during the past twenty years, and planters are thoroughly alive to the necessity of improvement, but all forestry operations require an extended period in which to produce results, and it must necessarily be a long time till better methods are able to exert their full effects. The rabbit has also had something to do with the understocked condition of many of our woodlands, and Mr. Stebbing's plea for complete extermination of this pest under any scheme of commercial afforestation is irresistible. It is only too true that forestry, like agriculture, has suffered in the past from systematic Government neglect. Forest products have had to compete with material brought at low cost from all parts of the world, with the result that the price of home-grown timber has been depressed to such a level that the woodland owner has regarded his plantations more as a hobby than as a serious commercial proposition.

Mr. Stebbing has a good deal to say about the employment of women in woodland operations, and already female labour is being usefully utilised in many of the lighter branches of forestry. More particularly they have been employed with success in the measurement of timber and in nursery work, but they have not shirked some of the heavier operations such as lopping, thinning and planting.

Some of the most interesting chapters in the volume are concerned with an attempt to estimate the sources from which this country must draw its supplies of timber during the next half century. Mr. Stebbing is intimately acquainted with the forestry conditions of Russia and Finland, and to these countries—especially to the former—he looks for supplies of material which will be necessary to restore the buildings of the devastated areas of Europe and to supply the requirements of our own country. There is no doubt that both European and Asiatic Russia possess enormous timber resources which have been indifferently utilised in the past, and the author pleads for exploitation of Russian forests on a large scale by means of British capital. Unfortunately Russia as a field for the investment of British capital has, during the past year, lost a good deal of its attractiveness, and the outlook would certainly require to be a great deal clearer than it is at present before capitalists in this country would be prepared to sink their money in investments in Russian territory. A dozen plates are used to illustrate the volume, and these add considerably to the value of a book which appears at an opportune moment, and which may with advantage be studied by all who desire to take a broad view of the present forestry situation.

WM. SOMERVILLE

Utilisation et Conservation des Fruits et des Légumes.—(Société des Agriculteurs de France. Paris, 1917.) This pamphlet contains the results of a Commission appointed by the Society of French Agriculturists to study the various processes by which fruit and vegetables can be preserved to the best advantage. The results are classified under three heads, and under each of these are given practical recipes for different kinds of fruit.

The "Appert" method consists in sterilising by means of air-tight jars; the fruit is placed in a jar or tin which is then hermetically sealed and placed in boiling water. The bottles should not be filled to the top but space should be left for what air remains inside to expand without breaking the jars. It is also important to see that the jars do not touch, unless they have previously been wrapped in straw or shavings to prevent their breaking. As soon as the bottles are immersed, the sealing can be tested by noticing whether air bubbles escape from any of them, and if so, this must instantly be put right. The temperature should be kept at not less than 100 degrees, and the time necessary for complete sterilisation will depend on the kind of vegetable to be preserved.

Another process similar to the "Appert" is that of sterilising by means of sulphuric acid. In this case, sulphur candles or flowers of sulphur are burned underneath the inverted jars, after which these are filled with the fruit and hermetically sealed. Fruit preserved in this way loses a little of its colour, but its flavour is not affected. If it is desired to preserve fruit without bottling, sulphur can be burned in the room or cupboard containing the fruit, in order to destroy any harmful germs already attacking it; but of course the preservation thus effected can only be of comparatively short duration.

Under the head of jam-making, many useful recipes are given by which to avoid the use of sugar, either by substituting for it honey or beetroot, or by concentrating the sugar contained in the fruit to a point at which additional sugar is unnecessary. Methods of preserving vegetables in vinegar and fruit in brandy are also described in detail.

The third and most time-honoured method is that of desiccation. In this country fruit-drying by exposure to the sun is scarcely practicable, but there remains the possibility of drying plums, pears, apples, &c., by leaving them in a moderate oven for several hours, then letting them cool and repeating the process two or three times. The authors of the pamphlet strongly recommend the use of an apparatus known as the evaporator, much used in California and not unknown in France. It consists of a box or cage through which hot air is blown from a stove on to the fruit or vegetables arranged on the shelves. However, this system, and also that of the cold storage, present difficulties with regard to apparatus from which the methods described earlier are free, and it is in these and in the detailed recipes, many of them contributed by the *Cordon Bleu* School of Cookery, that the chief usefulness of the pamphlet is to be found.

M. A. BURGE.

The Nutrition of Farm Animals.—Henry Prentiss Armsby, Ph.D., LL.D. Pp. xvii. + 743. Figs. 45. Price 11*s*. net. (New York. The Macmillan Company, 1917.) No branch of agriculture offers to the scientific adviser greater difficulties in the supply of reliable guidance than that of the feeding of live-stock. In the case of crop production, although a host of problems still await solution, the fundamental principles underlying plant growth have been sufficiently elucidated to enable reasonably sound guidance to be given to the practical man, as is indeed well exemplified by the measure of success which has been obtained in the application of science to practice in this direction. It is impossible, however, as yet to feel the same confidence in the application to practice of the results of scientific investigation in the field of animal nutrition, and, outside certain limited areas, the scientist can do little more than suggest the lines along which the practical man may tentatively seek for improvements in his methods. The reason for this lies partly in the extraordinary difficulty in the case of animals of carrying on experimental work of the character requisite for the elucidation of fundamental principles, and partly in the necessity for treating each animal as an individual unit. In the case of plants there is little difficulty in using large numbers of plants for any particular experiment, and thereby eliminating from the result the disturbing influence of individual variation from plant to plant. In the case of animals, on the other hand, especially the larger domesticated animals of the farm, even the most lavishly equipped experiment station can only deal with relatively small numbers at a time, each animal must to a certain extent be fed and cared for individually, and the experiment must consequently be repeated frequently before broad generalisations can be accurately deduced. Even then the needs of the practical man cannot be fully met without some indication as to how these generalisations or averages can be adapted to meet the requirements of the individual animal.

In view of these difficulties and of the fact that practically the whole of our knowledge of the scientific principles of animal nutrition has been gained within the last eighty years, it must be regarded as no mean achievement that at least the foundations of a sound science of nutrition have been securely laid. For this, as in the case of most branches of science, we have to admit a great debt to the German investigator, and all who are conversant with the literature of the subject are aware how largely scientific advice on feeding has hitherto been based upon German work. In recent years, however, a rapidly growing share in the investigation of this subject has been taken by American workers, and in so far as this work has related to farm animals, the name of Dr. Armsby has steadily forced its way into the very foremost place. The appearance of a new work from his pen must thus be regarded as an event of first-rate importance in the world of agricultural science.

In the present volume he has given a comprehensive survey of the existing state of knowledge in the field of animal nutrition primarily from the standpoint of fundamental principles, no attempt being made to deal exhaustively with the specific details of practice The book is thus essentially one for the student rather than for the practical farmer. Indeed it is more than probable that even the average advanced student in this country will find the matter difficult of digestion despite the lucidity with which the principles and their broad application to practice are discussed. To the teacher and adviser, however, the work comes as a great boon, and not least as a release from the thraldom of German literature to which in the past he has perforce been subject.

Throughout the work the experimental evidence upon which general conclusions are based is fully reproduced and discussed. This evidence is derived almost entirely from Continental and American investigations, but the British contribution to the subject is not entirely overlooked. The appearance of the work is timely in view of the urgent need at the moment for guidance as to the directions in which real economy can be effected in the feeding of stock, without undue sacrifice of efficiency. Although unsuited for the ordinary agricultural reader not possessed of a fair knowledge of chemistry and physics it may yet render great service to practical agriculture if its teachings are carefully studied and interpreted in the light of British conditions.

CHARLES CROWTHER.

The Determination of Farming Costs. C. S. Orwin. (Oxford, Clarendon Press, pp. 144, 5*s.* net).

The great industrial magnates have long learned the need for ascertaining costs of production ; only in that way have they been able to effect economies which, though small in themselves, are in the aggregate so large as to turn uncertainties into certainties, and failure into success. For this purpose large businesses employ highly trained accountants to secure accuracy, and they do this solely on the ground that it pays.

The farmer does not for several reasons. In the first place his attitude to his business is more personal than that of the manager of a large limited liability company. Like the business man of early Victorian days, he feels that it is his own, and that he must sink or swim with it Being committed "to the last shilling and the last acre," he will not hand over the detailed information to any one to work up. And while he will not let any one else do it he considers that he cannot do it himself. He is too tired in the evenings, and any way he has no fancy for the task. A further important factor is that he feels he is not entirely a free agent in the matter. A manufacturer works chiefly on contracts, which he is free to accept or not, as he pleases. It is indispensable to him that he should know the costs to a nicety, so that he can make his contracts accordingly. The farmer rarely works on contracts ; he grows, as the manufacturer would say, "for stock" ; he has no hand in fixing prices ; indeed, his production is so far speculative that he never quite knows what price he will receive. Knowledge of costs is therefore of less obvious moment to him, and is neglected accordingly.

But as Mr. Orwin convincingly shows in this book on "The Determination of Farming Costs," it is essential to a farmer who wishes to make any progress on the business side that he should know exactly what his operations are costing him. It is a commonplace that suggested improvements must be tested on costs, and not only on yields. A scheme that led to no increase in yield at all might nevertheless be very useful if it led to a reduction in cost of production.

Before much can be done in the way of ascertaining farm costs it is necessary to determine the principles on which they are to be worked out. How, for example, is one to determine the cost of growing wheat? Some of the operations were performed in part for the previous crop, and benefited that crop ; some will benefit the next crop. Even so simple a matter as the cost of keeping a horse is beset with pitfalls. Are you to charge his oats at 52*s*. per quarter, the price a merchant would pay for them, or at say 40*s*. per quarter, what they apparently have cost to grow? Many farmers would without hesitation charge the market price, but others, and among them Mr. Orwin, would maintain that the proper charge is the actual cost, whether incurred by purchase or by growing.

The discussion of these principles occupies a considerable portion of the book, and Mr. Orwin rightly devotes a good deal of space to this question of valuation of home-grown produce. The market price represents the value of the material to somebody else, and not necessarily to the farmer. A man may, of course, sell out if prices are sufficiently tempting, and he sees the possibility of using something else, but he ought no more to charge his oats to his horses at the price a London contractor would offer for them, than he ought to charge the man's time at the price a munitions factory would pay if it got the chance. In all cases the account must be debited with actual costs and not with any fictitious paper values.

This being settled, the next step is to proceed with the method of working. Several records are necessary. The first is needed to show the distribution of the capital invested in the different branches of the farm. On an established farm this will necessarily be in the nature of an estimate rather than a precise statement. An important adjunct is the stock book, a register of all the dead stock on the farm, and its value. The value is determined on a depreciation basis. For the first year it is put down at cost price, in the subsequent years at something less, the precise amount of the deduction or depreciation depending on the life of the article, and being agreed on beforehand. The next record needed is one showing the application of labour, both manual and horse. This is taken on time sheets handed out to the men, and kept by them. A third is the record of the live stock, the foods they consume, and whether these are consumed in the yards or on the land. Next, a record is wanted of the application of manures, both farmyard and artificials. This is a relatively simple matter. Lastly, a record must be kept of all receipts and payments for the farm, but excluding, of course, the farmer's private expenses. When these records are assembled it is possible to deduce from them the costs of production. The labour is not so great as it appears, because most farms are occupied only with certain branches of the business.

It is interesting to note that the Institute of Agricultural Economics, of which Mr. Orwin is director, offered to work up any records taken in this way, and to pass back to the farmer the information as to costs. One would have thought that the Institute would have been snowed under with applications, but in point of fact there was practically no response. Arrangements were made, however, for records to be kept on selected farms, and the results of these are here discussed, everything being suppressed which would tend to identify the farms in question.

One of the most striking results is the smallness of the increase of wages from 1907 to 1915. In other branches of industry there had been a distinct rise, in agriculture there had not. Mr. Orwin does not consider his data sufficient to decide whether or not the farm gains by having a little good labour well paid or much poor labour badly paid. Most people, we imagine, will prefer the former alternative, and in any case the minimum wage is now enacted beyond repeal. As bearing on the important question of the Saturday afternoon holiday, Mr. Orwin points out that less time is lost where this is given than where it is not.

An interesting comparison between German and British agriculture is made on page 67. Mr. Middleton had already shown that the production of food per hundred acres is considerably greater in Germany than it is here. On the other hand, Mr. Orwin is able to show that the production per man is fully 20 per cent. higher in this country than in Germany. A possible, even probable, cause of the difference lies in the size of the holding. In England less than 16 per cent. of the land consists of holdings under 50 acres, while in Germany nearly half (48·5 per cent.) is made up of these units. Thus in England there is greater opportunity for the use of machinery than in Germany. Then follows an interesting chapter on the cost of growing certain crops in 1915. Wheat came to 5*l*. 15*s*. per acre on one farm, 5*l*. 15*s*. 11*d*. on another, and 7*l*. 3*s*. 9*d*. on a third; barley and oats to rather less. The cost per quarter is also given.

Lastly, there is an interesting chapter on the net output from agriculture. When the first census of production was taken in 1907, the average net output per head of persons employed in the industries under review was 104*l*. per annum. In agriculture the output was 90*l*., or 129*l*. if the farmers themselves were excluded. In the cases investigated by Mr. Orwin the net output was 169*l*. per man per annum, excluding the farmer. Of this the labourer secured about 30 per cent., the farmer 48 per cent., the landlord 22 per cent. In reality, however, neither farmer nor landlord get all their share for themselves, as both have considerable out-payments to make. When these are allowed for it is seen that the labourer secures 40 per cent., the farmer 40 per cent., and the landlord 20 per cent. of the net returns.

This book should certainly be read by all farmers. It will set them thinking, and, we hope, keeping accounts as well.

E. J. RUSSELL.

Cold Storage of Meat.—In face of the difficulties experienced in this country in controlling the prices and supplies of meat, it is interesting to note the results of a debate held in November last by the Société des Agriculteurs de France, under the presidency of M. Moussu.

The problem of supply is inextricably involved in that of price. M. Moussu pointed out that a shortage of supplies must inevitably cause high prices; and if the Government is to fix the price of meat, prices of feeding stuffs and of artificial manures must also be fixed, otherwise a shortage of these will result as actually happened in the case of wheat.

M. Moussu's solution to both problems is to substitute a trade in dead meat for a trade in live stock. He suggests a scheme by which every district is provided with slaughter-houses and cold storage accommodation, situated in the centres of production. Thus as soon as the animal is killed the meat is placed in cold storage, and subsequently despatched by train to the various centres of consumption which should again be provided with ample cold storage accommodation. This arrangement would admit only the minimum of wastage; it would also facilitate transport very considerably, as it would remove all the difficulties and risks of conveying for long distances live stock and the foods necessary for it during the transit.

As a result of a system similar to this, the United States have succeeded both in maintaining an adequate supply of meat and also in reducing the price by 20 to 25 per cent.; and M. Moussu urges that no other system can strike at the root of the present evil.

REPORT OF THE COUNCIL TO THE ANNUAL GENERAL MEETING OF GOVERNORS AND MEMBERS OF THE SOCIETY,

HELD AT 16 BEDFORD SQUARE, LONDON, W.C.

On WEDNESDAY, December 5, 1917, *at* 12 *noon.*

Membership.

The Council have to report that the list of Governors and Members has undergone the following changes during the year which has elapsed since the Annual General Meeting on December 6th, 1916; 45 new Governors (includng 2 transferred from the list of Members under By-law 7), and 1143 new Members have joined the Society, and 1 Member has been re-instated under By-law 14; whilst the deaths of 2 Life Governors, 11 Governors, 1 Honorary Member, 112 Life Members, and 163 Members have been reported. A total of 21 Members have been struck off the books under By-law 12, owing to absence of addresses; 2 Governors and 107 Members under By-law 13, for arrears of subscription; and 1 Governor and 185 Annual Members have resigned.

Death of H.R.H. Prince Christian, K G.

The Council have to deplore the loss of H.R.H. Prince Christian, who had always been a consistent friend to Agriculture. In the year 1875 His Royal Highness became a Governor of the Society; and subsequently, in 1879, he accepted the invitation of the Council to a seat on their body, becoming a Vice-President in 1890 and a Trustee in 1910. His Royal Highness was President of the Society in 1902, when the Show was held at Carlisle, and previously had taken the greatest interest in the arrangements for the Jubilee Show of the Society, held at Windsor in the year 1889, under the Presidency of Her Majesty the late Queen Victoria The Council desire to record their grateful acknowledgments of the great services Prince Christian had so graciously rendered to the Society in the several offices filled by His Royal Highness.

Deaths of Governors and Members.

Amongst the Governors and Members whose loss the Society has to deplore are the Duke of Norfolk, K.G., Earl Grey, the Earl of Haddington, the Earl of Harrington, the Earl of Londesborough, the Dowager Countess of Lonsdale, the Earl of Mount Edgcumbe (1861), the Earl of Suffolk, Lord Allerton, Lord Clonbrock, Lord Haversham, Lord Masham, Lord St. Audries, Sir J. Prichard Jones, Bart., Sir S. Neumann, Bart., the Rev. Sir D. V. Vyvyan, Bart., Sir James Whitehead, Bart., Sir Henry A. Wiggin, Bart., Col. Sir E. T. D. Cotton-Jodrell, K.C.B., Sir Charles Forster, Sir Somerville A. Gurney, Sir Henry R. Miles, Sir Thomas Milvain, Sir Edward Wood, Mr. F. Pratt Barlow, Mr. J. A. Bell, Mr. Herman Biddell (1862), Mr. C. Atherton Brown, Mr. A. Tremayne Buller, Mr. W. B. Canning, Mr. Philip Chasemore, Prof. A. Chauveau (Hon. Mem.), Mr. Henry C. Clarke, Mr. John Conchar, Mr. Thomas Corbett, Col. W. C. Dawson, Mr. Leopold de Rothschild, Mr. G. J. Drummond, Capt. G. R. B. Drummond, Mr. Charles Duckering, Col. W. H. O. Duncombe, Mr. W. Eve, Mr. G. B. Ffolkes, Rt. Hon. F. J. S. Foljambe, Mr. George Gibbons, Mr. Arthur S. Gibson, Mr. J. Eglinton A. Gwynne, Mr. George Hunt (Consulting Surveyor to Society), Mr. Charles E. Hunter, Mr. Alexander Iles, Mr. John Arthur James, Mr. E. C. Jobson, Mr. W. H. P. Jenkins, Mr. Arthur King, Mr. H. T. King, Mr. John H. Knight, Mr. A. G. Leighton, Capt. W. Parr Lynes, Mr. Herbert Mackinder (1863), Mr. G. H. Meire, Dr. N. H. J. Miller, Mr. Herbert A. Neame, Mr. J. T. Oxley, Mr. Chas. F. Paddison, Mr. John Pakeman, Mr. T. Pears, Mr. A. J. Pell, Mr. T. V. Pettifer, Mr. D. W. Philip, Mr. J. H. Raffety, Col. H. B. O. Savile, C.B., Mr. W. T. Sharpe, Mr. H. H. Smith-Carington, Mr. Daniel Swaffer, Mr. W. Tamlin, Mr. G. F. Wells-Cole, Col. W. Cornwallis West.

The deaths of the following Members of the Society have occurred whilst on active service: Capt. the Hon. Neil Primrose, M.C., M.P., Capt. H. Brassey, Capt. Charles Cecil, Mr. Philip Crowley, Capt. J. H. Cuthbert, D.S O., Capt. Godfrey FitzHugh, Mr James Hartnoll, Mr G. Lawson Lewis, Mr. Percy Lee Pemberton, Mr. W. N. Soames, and Lieut.Col. A. C. Thynne, D.S.O.

Number of Governors and Members on Register.

The above, and other changes, bring the total number of Governors and Members now on the Register to 10,861 divided as follows:—

208	Annual Governors;
92	Life Governors;
8,134	Annual Members;
2,402	Life Members;
25	Honorary Members;

10,861. Total number of Governors and Members as against a total of 10,278 Governors and Members on the Register at the time of the last Annual Report. The election of 45 New Governors and 1,143 New Members is an undoubted proof of the satisfaction felt among agriculturists of the work the Society has done during the past year.

Annual Election of Council.

Under the scheme of rotation settled in 1906, the Members of Council who retire at the Annual Meeting in December next, are those representing the following electoral districts comprising Group "A":—Northumberland, Yorks (North Riding), Lancashire and Isle of Man, Cheshire, Derby, Northampton, Norfolk, Bedford, Hertford, Middlesex, Stafford, Worcester, Monmouth, Cornwall, Dorset, Hampshire and Channel Islands, and Scotland. The Members of the Society resident in those districts have all been communicated with, and the necessary measures are being taken for the election or re-election of representatives for the divisions concerned. In consequence of the diminution of the membership in Norfolk, this county will have its representation reduced to two Members on the Council.

Accounts.

In accordance with the By-laws, the balance-sheet has to be presented for consideration at the Annual General Meeting. The Council therefore beg to submit the balance-sheet for the year 1916, with the Statement of Ordinary Income and Expenditure. These accounts were published in Volume 77 of the Journal issued to Members this year, having been duly examined and certified as correct by the Auditors appointed by the Members, and by the professional Accountants employed by the Society.

Agricultural Relief of Allies.

The fund for giving help in kind to the farmers in the devastated districts of our Allies has increased to a total of approximately £150,000, including promised subscriptions and the value of relief already given.

The work of the Committee has been directed towards strengthening the organisation and making preparations for the distribution of relief on a wide scale the moment the opportunity arrives.

Among recent consignments to France have been a large quantity of Scotch pine tree seeds, and several thousand head of poultry, which have been distributed among small farmers who have returned to their holdings on soil re-conquered from the enemy by the British Army.

A consignment of 10,000 fruit trees recently dispatched will, to some extent, assist in repairing the damage to the orchards of France wantonly wrought by the enemy.

The practical support of the Agriculturists of the Overseas Dominions has been secured, and active organisations have been instituted throughout the Empire.

Cardiff Show.

The Society having accepted the invitation from the citizens of Cardiff to hold the Annual Show in that city this year, the necessary arrangements for complying with the invitation were proceeded with, and the Showyard Plant was removed from Manchester to the site of the Show at Cardiff.

The Council had taken the necessary steps with the departments of the Government concerned and had received authority from the Ministry of Munitions to proceed with the erection of the Showyard.

Subsequently Sir Gilbert Greenall, Mr. Adeane, and the Secretary attended a Meeting of the Local Committee at Cardiff at which a representative of the Great Western Railway Company was present Having regard to the statements made by this gentleman as to the difficulties of transport of Exhibits and Visitors, it was decided that it would not be possible to hold the Show, and the President undertook to submit this decision to the Council, who, at their Meeting held on the 6th December. approved the action of their President-elect and the Hon. Director. The President having explained the action which had been taken by the Ministry of Munitions in prohibiting the holding of the 1917 Show, the Council unanimously decided to accept the cordial invitation which had that day been extended by the Lord Mayor of Cardiff, who was present, on behalf of the City, to hold the first Show of the Society after the War at Cardiff, the Marquis of Bute having very kindly allowed the Showyard Plant, which had already been delivered on the site, to remain for the following year.

Trial of Ford Tractor.

At the request of the Food Production Department of the Board of Agriculture and Fisheries, the Council undertook the trial of the "Ford" Agricultural Tractor, the plans and specifications of which, as well as the services of his experts, Mr. Ford had placed at the disposal of the Board.

Arrangements were made for the trial of the two "Ford" Agricultural Motors in use in this country, on land kindly provided by Sir Gilbert Greenall on his estate in Cheshire.

The Judges who acted were:—Professor Dalby, F.R.S., of the City and Guilds Engineering Institute, South Kensington, Mr. Courtney, the Society's Consulting Engineer; Mr. Greaves, Chairman of the Implement Committee representing both Engineering and Practical Agriculture; Mr. R. W Hobbs and Mr. Henry Overman, Practical Agriculturists.

The Report of the Judges was favourable, and bearing in mind the existing circumstances, they recommended that steps be taken to construct immediately as many of these Tractors as possible.

In response to the communication containing the Report the following letter was received from Col. Sir Arthur Lee:—

[Copy.]

Board of Agriculture and Fisheries,
Food Production Department,
72, Victoria Street,
London, S.W. 1.
May 3rd, 1917.

Dear Mr. McRow,—I shall be much obliged if you will express to the Royal Agricultural Society my sincere and grateful thanks for the extremely valuable and satisfactory report which they have furnished to this Department on the merits of the Ford Tractor for agricultural purposes. I recognise that it was asking a good deal of the Society to organise and carry out this trial at such short notice, but the result has been most helpful, and indeed invaluable, to me.

Will you kindly convey my special thanks to the distinguished panel of judges who kindly undertook this work?

Yours very truly,
(Signed) Arthur Lee.

Judges for Palermo Show.

At the request of the Sociedad Rural Argentina, the Council appointed the following Judges to act at the Palermo Show in September last:—

Mr. **Robert Bruce**, Firlands, Fochabers, N.B. (Shorthorns).
Mr. **George Bean**, West Ballochy, Montrose, N.B. (Clydesdale Horses and Aberdeen Angus Cattle).
Mr. **James Whinnerah**, Warton Hall, Carnforth, Lancs. (Shires, Hackneys and Light Saddle Horses).

Mr. J. E. CASSWELL, Laughton Cottage, Cromer (Down, Lincoln and other Long Wool Sheep, and Pigs).

These gentlemen have carried out their duties, and have returned to this country.

War Emergency Committee.

The War Emergency Committee was appointed by the Council at their meeting on December 6th, 1916, to deal with questions relating to Agriculture, and more especially with regard to the Food Production of the Country during the War. During the year many meetings have been held, at which matters of importance affecting the objects for which the Committee was formed have been considered, and representations made to the several Departments of the Government concerned.

In response to an invitation from the Board of Agriculture the Committee appointed four of its Members to act on a Joint Committee, consisting of representatives of the Board and the Royal Agricultural Society, to deal more particularly with matters affecting Live Stock. The Society's representatives were Mr. Adeane (President), the Earl of Northbrook, Sir Gilbert Greenall, and Mr. Alfred Mansell.

On the 20th December, 1916, the Rt. Hon. Rowland E. Prothero, President of the Board of Agriculture and Fisheries, attended the meeting of the Committee, and made a statement on the agricultural situation of the moment.

The supply of Fertilisers received the early attention of the Committee, who pointed out the necessity which existed for the necessary amount of these manures to be available for increased food production. They urged that the Government should prohibit the exportation of Sulphate of Ammonia and Basic Slag, and the suggestion respecting Sulphate of Ammonia was shortly afterwards adopted by the Government.

The Committee expressed the opinion that a price should not be fixed for any agricultural produce without taking into consideration the cost of production, and unless the price of feeding stuffs, fertilisers, etc., was fixed also.

The Committee have urged that compulsion to plough up grass land should be accompanied by the establishment of guaranteed minimum prices for all cereals for a period of years, and this policy has since been adopted by the Government and embodied in the Corn Production Act.

Caution was urged in the endeavour to bring more grass land under cultivation, and the Committee suggested that the programme should be kept within the limits imposed by present supplies of labour, horses, and machinery. It is satisfactory to know that the Government modified materially the original programme, and adopted a much more reasonable attitude in bringing forward their new proposals. Mr. Prothero, moreover, laid down the principle that grass land which is fully productive for milk or for fattening cattle should be left down, and indicated that grass land for breaking up must be carefully chosen.

As far back as May the Committee urged that any proposals for maximum prices for beef should not come into operation until the 1st September, and that fixed prices should be announced as soon as possible. In June they passed a resolution asking (1) for an immediate declaration as to the maximum prices for meat; (2) that ample notice should be given before such prices came into operation, and not having received a satisfactory reply in the meantime the Committee, on July 10, drew attention to their resolution, and pointed out that the delay in announcing these prices was causing great uncertainty amongst the farmers, who were anxious to buy store stock, and that any further delay would seriously jeopardise the meat production of the country. On the 21st July the Food Controller issued his scale of prices for beef for the Army, beginning with 74s. per live cwt. in September, descending to 72s. in October, 67s. in November and December, and 60s. in January. The Committee strongly deprecated the reduction for January and winter months, when beef was most expensive to produce.

Figures giving the cost of producing a store bullock, 18 months old, and the loss on feeding a beast on a ration including cake and on a ration from which cake is excluded, were prepared by the Committee, after thorough inquiry into actual cost in various parts of the country, clearly demonstrating the impossibility of profitable beef production at the prices laid down.

These figures were communicated to the President of the Board of Agriculture, and subsequently published in the Press.

Within a very short time of the publication of these figures representatives of the Committee and other agricultural bodies were invited to wait upon the Food Controller. Lord Rhondda then announced the Government's decision to prolong to the end of June, 1918, the operation of the prices fixed for December—67s. per live cwt. and 8s. per stone dead weight.

Attacks have been made in various quarters against the farming classes as a whole, and it was obvious that many of them were the outcome of ignorance of the position. But when allegations—first of apathy as to the necessities of the moment and later of profiteering—had the appearance of having been influenced by official sources, the Committee made the most emphatic protest, not only in defence of the farmer but in the interests of confidence and increased production. The Prime Minister, at a recent Conference, stated that not only was he not in sympathy with the abuse of the farmer, but deprecated it in the strongest possible manner; it was mischievous to the last degree.

The Committee, while defending the interests of Agriculturists, have urged them to make full use of all reasonable facilities as they were provided. The Committee impressed upon breeders the necessity for the greatest economy in the use of feeding-stuffs and in other ways have given the weight of their influence in the support of the official campaign for food production and food saving.

Amongst other subjects in regard to which the Committee have offered carefully considered opinions are the following: Varieties of wheat for spring sowing; the price of Milk Orders; repatriation of cast Army horses; prices of potatoes; labour for threshing machines; facilities for the purchase of tractor ploughs by War Agricultural Committees; light horse breeding; commandeering of farm produce; and supplies of binder twine. In regard to milk, the Committee communicated to the authorities their view of the need for an early assurance being given to farmers that the price for the winter milk would afford a reasonable profit, and this representation was followed by official action in the direction desired.

The Committee have also urged that breeders and feeders of live stock should be taken into the confidence of the Government before dealing with the rationing of live stock.

Occasional Notes.

The Council at their Meeting on the 28th March, 1917, decided to issue to Members periodically Notes by the Scientific Officers of the Society on matters which might be useful at the time for Members' information and guidance. These Notes have hitherto been included in the Annual Reports of the Scientific Officers, and published in the Annual Journal, but it was thought that frequently the Notes lost their significance by being kept until the publication of the Journal, which was frequently several months after the Reports had been made. Two issues of the Notes have appeared, the first in April and the second in July, and a third number will be issued when occasion requires.

Library.

The Council having discussed the question of a complete record in printed form of the books in the Society's Library, many of which are of great value, and in some instances very rare, it was decided to employ the services of an expert Librarian to rearrange the Library, and to prepare a catalogue of which it is intended to print a number of copies for the use of Members of the Society who are interested in books relative to the Agricultural industry.

Chemical Department.

During the past twelve months the number of samples analysed in the Society's Laboratory has been about 50 in excess of those in 1916, the figures being 307 as against 250. Great difficulties have been experienced alike in the supply and in the greatly increased prices charged for both fertilisers and feeding stuffs.

A number of new materials have been submitted for examination to take the place of others now with difficulty procurable, such as seaweed ash, flue dust, cocoa shells, silk waste, flax bols, etc. None of these have attained much use except the flue dust from furnaces, which has been found to contain a material amount of potash, and thus to supply in part the lack of potash salts

Endeavours to utilise nitre cake in the manufacture of superphosphate in part replacement of the oil of vitriol, required so largely for munitions, have not met with any measure of success, and the so-called "war-time superphosphate" has not had any extended use.

During the year the Chemical Committee found it advisable to revise their recommendations in the case of basic slag, introducing figures expressive of the "citric solubility" as well of the contents in total phosphoric acid.

The issue of "Occasional Notes," dealing with matters of immediate importance and reported from the scientific departments of the Society, has been vigorously supported from the Chemical Department.

Woburn Experimental Farm.

Pursuant to a request from the President of the Board of Agriculture, it was decided to undertake this year as little new work of inquiry as possible, but to devote the Experimental Farm to the raising of corn crops mainly and to demonstrations bearing on this. Accordingly, the current work of past years was maintained, but not extended, and the endeavour was made to see what could be done in corn-growing by the more free use of artificial manures such as were generally available at the time. Sulphate of ammonia in particular was largely used in this connection. A fresh series of calf-rearing experiments had been begun in October, 1916, and these were carried on, bearing, as they did, on economy in feeding, and on the replacement of milk by water in the feeding of calves.

An interesting experiment bearing on the amount of dung produced in a yard by the consumption of hay and other foods, and which had importance in questions of valuation, was duly carried out, and the results were such as to bring about a revision of the practice hitherto followed in valuation in certain parts of the country.

The Hills' experiments were continued at the Pot-culture station, and new experiments were devised in relation to new sources of potash, the use of nitre cake, "war-time superphosphate," etc.

The Annual Visit of Members to the Woburn Farm was again, owing to difficulties of travelling, suspended, but the Farm Committee made their usual inspections.

Botanical Department

One of the direct results of the policy of increasing our home-grown supplies of food has been to extend the work of the Botanical Department appreciably. The outstanding feature of the past season has been the great increase in the number of inquiries dealing with the cultivation of wheat. The difficulty of sowing a sufficiently large area during the autumn and winter months led, early in the year, to many requests for information on the cultivation of spring wheats, some of which had not been anticipated in a leaflet issued on the subject. Fortunately information on most of these points had been accumulated in the preceding year, which could be placed at the disposal of Members. Immediately after harvest inquiries were numerous with regard to the best cropping and the best weather-resisting varieties, whilst now our main concern is to keep pace with the examination of sprouted samples to determine whether it is better to obtain fresh stocks of seed or waste a certain amount of food by increasing the seed rate in order to make up for deficiencies in the germinating capacity of the grain to be sown.

Early in the season there was a distinct falling off in the number of seed samples sent in for testing, though later the numbers reached to about the same level as in the previous year.

This branch of the Department's work differed somewhat from that of former years. Few tests were made of grasses other than the two rye-grasses and cocksfoot. The number of clovers examined was about the normal and for some unaccountable reason not a single sample of mangold seed was received for testing. On the other hand the number of cereal samples, especially of oats, again increased

Throughout the growing season the crops were unusually healthy, and though inquiries were frequently made with regard to fungoid diseases, most of them were concerned with diseases of second-rate importance. The minor diseases of the potato, often confounded with *Phytophthora*, headed the list of these, as was only to be expected in view of the fact that many were growing potatoes for the first time on a large scale. Next in numerical order came the diseases of garden crops, one of which, *Septoria apii*, a celery pest, appears to be unusually prevalent at the present time. The methods of preparing fungicides, more especially Bordeaux and Burgundy mixtures, were the subject of numerous inquiries

The identification of weeds and the suggestion, where possible, of special measures for their eradication, has also become an important branch of the Department's work.

Zoological Department.

The past season has been the busiest ever experienced by the Zoological Department. This has been due in part to the exceptional severity of insect attacks on crops during 1917, and in part, no doubt, to the vast increase in the numbers of allotment holders and small growers who have applied for advice. There have been few cases of new or rare pests, but many of those already familiar to the farmer have been quite unusually injurious.

In addition to the routine work of advising Members in these matters a new leaflet has been written on the Warble-fly, embodying our present knowledge of the life-history of that pest. A special visit has also been paid to the Evesham district to investigate insects attacking plum trees, and a special Report on the two beetles concerned, *Xyleborus dispar*, and *Scolytus rugulosus*, has been printed by the Society and distributed among the fruit growers especially interested.

Veterinary Department.

Since the beginning of the year the returns with regard to the scheduled contagious diseases of animals have been comparatively satisfactory, except in the case of sheep scab. The outbreaks of anthrax have been below the average of recent years, and those of glanders have been the lowest recorded. There has been a slight increase in the number of reported outbreaks of parasitic mange in horses. The outbreaks of swine fever show a reduction of about 50 per cent., as compared with the previous year, which is very satisfactory, in view of the fact that the restrictions on movement are now less severe than they were before the introduction of serum treatment as the principal method of dealing with the disease. Unfortunately, the increased prevalence of sheep scab which showed itself in the latter part of 1916 has been continued, and during the current year the outbreaks have been more than twice as numerous as in the previous year.

Sheep Scab.

The Council have frequently had under consideration the increase in the number of outbreaks of sheep scab recorded in Great Britain, and have written several letters to the Board of Agriculture and Fisheries conveying the expression of alarm felt by them at the increase of outbreaks in 1916 as compared with 1915, and expressing the hope that the Board would take energetic steps to deal with the question. In February last the Board of Agriculture stated that the matter was receiving their careful attention, and pointed out the measures provided by the Sheep Scab Orders of 1905 and 1910, as to isolation and dipping of sheep. The Board expressed the hope that the enforcement of the restrictions would result in preventing the distribution of sheep scab, and stated that if these measures were found to be insufficient for that purpose the President of the Board would not hesitate to adopt such other means as might be considered necessary and expedient.

On July 25th the Veterinary Committee reported the receipt of a letter from the Board of Agriculture saying that the President did not think that sufficient time had elapsed to enable a fair judgment to be given as to whether the measures above referred to had been successful in preventing the distribution of the disease. The Council regarded with grave concern the ill-success of the restrictive measures which the Board of Agriculture had put into force in the expectation that they would lead to a material reduction in the number of outbreaks, as these had continued to increase and were 118 per cent. more than those reported up to the same date last year. These facts were pointed out to the Board of Agriculture, who were at the same time informed that the Council's opinion was that if the disease was to be successfully controlled no time should be lost in dealing with it drastically, as the difficulties then were less than in the later period of the year.

The Board of Agriculture, in reply to the Council's communication of the 30th July, addressed the following letter to the Society:—

[Copy of Letter from the Board of Agriculture *re* Sheep Scab.]

Board of Agriculture and Fisheries,
4, Whitehall Place,
London, S.W. 1.
11th September, 1917.

No. A. 676/1917.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to your letter of the 30th July as to the number of outbreaks of sheep scab in Great Britain during the current year, as compared with the corresponding period of 1916, and to furnish for the consideration of the Society the statement below as to the outbreaks during the twelve months ending 30th June last, and during the corresponding periods of the preceding twelve months, together with the Board's comments thereon.

	3rd Quarter. *1916.*	4th Quarter. *1916.*	1st Quarter. *1917.*	2nd Quarter. *1917.*
England	7	110	148	31
	1915	*1915.*	*1916*	*1916.*
	3	67	90	11
Scotland	11	110	134	20
	1915.	*1915.*	*1916.*	*1916.*
	4	15	33	13
Wales ...	2	7	40	10
	1915.	*1915.*	*1916.*	*1916.*
	—	12	26	4

It will be seen that there were abnormal increases during the fourth quarter of 1916 and the first quarter of 1917, and that the increases were far greater in Scotland than in England. As was pointed out in the Board's letter of the 14th February last, the increase was accounted for to a considerable extent by the number of small outbreaks in Scotland, involving in the majority of cases a very small number of sheep—in some instances only one animal—and that a number of the outbreaks were also attributable to sheep moved from the Western Islands of Scotland. There is also strong reason to believe that many more of the outbreaks, both in England and Scotland, have been to a large extent due to sheep moved from the Islands and from the remote parts of the Highlands. With the object of preventing a recurrence of a similar spread of disease, restrictions have been imposed which require that such sheep shall be dipped before they leave their native localities, but as the movement of these sheep takes place in the autumn months any benefit derived from these special restrictions will not become apparent before the end of the year.

The relevant Orders of the Board have to be executed and enforced by the Local Authority, who are at present much hampered in the execution of their duties by the loss of Officers who act as Inspectors under the Diseases of Animals Acts, and the depletion of experienced shepherds and the Board would hesitate to add to their responsibilities at the present time.

If, however, the Society have specific proposals to submit, Mr Prothero would be glad to give them careful attention.

I am, Sir,
Your obedient servant,
(Signed) A. D. HALL, Secretary.

The Council have decided to ask Mr. Prothero to receive a Deputation on which the Earl of Northbrook, Mr. Davis Brown, Mr. Alfred Mansell, and Mr. Ernest Mathews were appointed to discuss the question.

Diseases of Animals Act of 1896.

Having regard to the importance of protecting the live Stock of this Country from the introduction of Contagious diseases, the Council have forwarded to the Board of Agriculture the following Resolution, which was unanimously adopted at their meeting on the 7th November, 1917:

> "That the Board of Agriculture be asked to give an assurance that no proposal shall be brought forward for the

repeal of the Diseases of Animals Act of 1896 until the Royal Agricultural Society and the Breed Societies interested have been consulted."

Bacteriological Problems.

In order that Members of the Society may obtain advice on Bacteriological and other intricate questions connected with Dairying, the Society has arranged with the Research Institute in Dairying, University College, Reading, to undertake the investigation of such problems.

Members wishing to take advantage of this privilege should communicate with THE DIRECTOR, RESEARCH INSTITUTE OF DAIRYING, READING.

Medals for Cattle Pathology.

As the result of the competitive examination at the Royal Veterinary College for the Society's Medals for proficiency in Cattle Pathology, including the diseases of Cattle, Sheep, and Pigs, the Silver Medal has been awarded to Mr. L. P. Pugh, of Pennard House, Sevenoaks, and the Bronze Medal to Mr. F. C. Scott, of Womersley, Pontefract.

"Queen Victoria Gifts."

The Trustees of the "Queen Victoria Gifts" Fund have made a grant of £140 for the year 1917 to the Royal Agricultural Benevolent Institution to be distributed as fourteen grants of £10 each to the five male candidates, five married couples, and four female candidates who polled the largest number of votes in their class, and who would not this year receive grants from any other fund in connection with the Royal Agricultural Benevolent Institution.

National Diploma in Agriculture.

The Eighteenth Annual Examination for the National Diploma in Agriculture was held at the Leeds University from the 21st th 25th April last, when eight candidates were successful in obtaining the Diploma. For list, see page 168.

National Diploma in Dairying.

The Twenty-second Examination for the National Diploma in Dairying was held this year for English students from September 15th to 20th, at the University College and British Dairy Institute, Reading; and for the Scottish students from September 22nd to 28th, at the Dairy School for Scotland at Kilmarnock. Fourteen candidates were examined at the English Centre, of whom 9 were successful, and at the Scottish Centre 21 candidates were examined, of whom 10 passed. The names of the Diploma winners will be found on page 171.

By order of the Council,
THOMAS McROW,
Secretary.

16, BEDFORD SQUARE,
LONDON, W.C. 1
7th November, 1917

NATIONAL AGRICULTURAL EXAMINATION BOARD.

I.—REPORT ON THE RESULTS OF THE EIGHTEENTH EXAMINATION FOR THE NATIONAL DIPLOMA IN AGRICULTURE,

HELD AT LEEDS, APRIL 21 TO 25, 1917.

1. The Eighteenth Examination for the NATIONAL DIPLOMA IN AGRICULTURE was, by the courtesy of the authorities, held at the University of Leeds, from the 21st to the 25th April last.

2. The subjects of Examination were Practical Agriculture (two papers), Farm and Estate Engineering (including (a) Surveying, (b) Farm Buildings, (c) Machinery and Implements), Agricultural Chemistry, Agricultural Botany, Agricultural Book-keeping, Agricultural Zoology, and Veterinary Science. Under the Regulations, the whole eight papers may be taken at one time, or a group of any three or four in one year and the remaining group of four or five in the year following Candidates taking the whole Examination in one year who fail in not more than two subjects are allowed to take those subjects alone in the succeeding year. Candidates failing in a single subject of a group are permitted to take that subject again in conjunction with the second group.

3. Twenty-five candidates presented themselves, as compared with 35 last year. One candidate took the whole Examination, 9 who had previously passed in certain subjects appeared for the second portion, and the remaining candidates came up for a group of subjects.

4 The following are the names of the 8 Diploma winners in alphabetical order :—

MICHAEL J. FAGAN, Royal College of Science, Dublin
W D D JARDINE, Harris Institute, Preston, Lancs
DAVID G IRONSIDE, North of Scotland College of Agriculture, Aberdeen
CHARLES A KLOPPENBURG, Harper-Adams Agricultural College, Newport, Salop.
WILLIAM MIDDLETON, North of Scotland College of Agriculture, Aberdeen
FREDERICK PEARCE, Harris Institute, Preston, Lancs.
MORGAN SHEEHY, Royal College of Science, Dublin
H W TOMLINSON, Harper-Adams Agricultural College, Newport, Salop

No candidate on this occasion reached the honours standard.

5. Of the 15 candidates appearing for a first group of subjects, the 9 whose names are given below succeeded in passing, and are therefore entitled to take the remaining subjects at a subsequent examination, when, if successful, they will be awarded the diploma :—

CATHERINE E AITKENHEAD, West of Scotland Agricultural College, Glasgow.
JOHN ARMOUR, West of Scotland Agricultural College, Glasgow
FREDK C E BOBBY, Harper-Adams Agricultural College, Newport, Salop
O CHANCE CASSELS, Harper-Adams Agricultural College, Newport, Salop.
H W MILES, Harper-Adams Agricultural College, Newport Salop.
JAMES C MITCHELL, Harper-Adams Agricultural College, Newport, Salop.
L C ROBINSON Harper-Adams Agricultural College, Newport, Salop
R N. K SUNDRAM, West of Scotland Agricultural College, Glasgow
G LEE WHYTE, North of Scotland College of Agriculture, Aberdeen

Three of the 6 unsuccessful candidates failed in a single subject, which, under the regulations, they will be entitled to take again next year in conjunction with the second group.[1]

6. The Reports of the Examiners in the different subjects are appended :—

PRACTICAL AGRICULTURE (First Paper, 300 Marks Second Paper, 300 Marks) Professor William Somerville, M A, D Sc, Edward Porter, B Sc, and John Gilchrist.

The papers were up to a fair average three, so far as agriculture is concerned, being qualified for Honours The question that produced the least satisfactory answers was that which dealt with the Agricultural Returns, a subject which though specifically mentioned in the Syllabus, does not seem to have been dealt with by the teachers who prepared the candidates

FARM AND ESTATE ENGINEERING. (300 Marks) (a) Surveying and (b) Farm Buildings, R Strachan Gardiner, F S I (c) Machinery and Implements, I Wibberley, N D.A, N D D

Surveying and Farm Buildings —There were only eight candidates in these subjects, and with two exceptions the work was not of a high standard. I have again to draw attention to the inadequate knowledge of Ordnance Maps and to the need for more practice in plotting and the use of plotting scales

Machinery and Implements —With the exception of two candidates the knowledge displayed, both in the oral and written examinations, was of a very low standard indeed, and cannot be described by any other term than that of "catalogue knowledge knowledge which a candidate might acquire by reading a few manufacturers catalogues just prior to the examination

Leaving out the question of examinations, the time has now arrived, in my opinion, when every agriculturist should give the matter of farm machinery and farm engineering the most serious attention For years the farm and the 'factory," meaning by the latter word all manufactures and textile industries, have been in direct competition for the labour supply, a condition of affairs which the war has intensified. After the war it is more than probable that this competition will be even greater, and the solution from the standpoint of an agriculturist, is to adopt the factory method of using, wherever possible, every labour saving device of proved merit

In my experience, both as a teacher of agricultural sciences, and as one whose practical farming operations at the present time include over 1 000 acres of tillage farming I have no hesitation in saying that a knowledge of agricultural engineering has proved more valuable than any other branch of knowledge in connection with agriculture

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[1] To meet the cases of candidates who have passed a portion of the examination, and who in consequence of their having joined His Majesty's Forces, may be unable to present themselves for the remaining subjects the Board have agreed to grant to such candidates an extension of one year in which to complete the examination. The Board will also be pleased to consider applications for any further extensions of time that may be found necessary

I should again like to point out that the award of marks in this section of the Examination is not made in such a manner as to impress a candidate with the importance of the subject. The section is divided into three sub-sections: (*a*) Surveying. (*b*) Farm Buildings, (*c*) Machinery and Implements. The marks are awarded in such a manner that 100 marks are obtainable in each sub-section, and if a candidate obtains a gross total of 150 marks for the whole section he or she obtains a pass. In practice, this means that a candidate may obtain a pass with a very meagre knowledge of section (*c*). A study of the marks awarded in the recent Examination will show that by this arrangement three out of the eight candidates failed absolutely in section (*c*), yet obtained a pass when the total marks for the whole section were aggregated.

I would respectfully like to suggest to the Examining Board the desirability of so adjusting the marks awarded in the section that it would be possible for an examiner to fail a candidate who did not obtain pass marks in such an important part of the Examination as that concerned with Machinery and Implements.

AGRICULTURAL CHEMISTRY (300 Marks) E J Russell, D.Sc, and Professor Edward Kinch, F I C, F.C S.

Some of the candidates showed a lack of knowledge of fundamental chemical principles and also a want of exactness in the use of terms of expression, *e g*, there was confusion between elementary nitrogen, combined nitrogen and ammonia; between lime and calcium carbonate; and between phosphoric pentoxide, phosphoric acid and phosphates. Generally the laboratory work seemed to have been well done, but in a few cases more elaborate processes were attempted than seem desirable in the time allotted to this work, which time would be better given to fundamental matter, *e.g.*, a candidate who had gone through a long laboratory course thought that sulphate of ammonia should not be mixed with superphosphate of lime because loss of nitrogen would ensue.

AGRICULTURAL BOTANY (300 Marks) Professor John Percival, M.A.

The work of the candidates was of a moderate character only. While the majority had a fair knowledge of grasses and farm seeds, few were properly acquainted with the botanical characters of common weeds, cereals, and root crops.

AGRICULTURAL BOOK-KEEPING (200 Marks) Alex. McCallum, M.A, LL B.

With few exceptions the papers in Book keeping were disappointing showing, as they did, an evident want of ability to use the methods in dealing with transactions put before them in a way to which they had not been accustomed. A thorough knowledge of the principles with a good deal of training in the application of these in a wide variety of exercises ought to be possible of attainment for every student of the subject, and it is not unlikely that this requires more time than is at present given to the subject at most institutions.

The general questions were not well answered.

AGRICULTURAL ZOOLOGY. (200 Marks) John Rennie, D Sc.

On the whole the results in this subject were satisfactory, and nearly all the candidates did passably good work in both the written and the oral tests. Most were able to identify readily a considerable number of field pests, parasites, &c., but too many were weak in their knowledge of remedial and preventive treatment. The practice of reproducing text book figures in the laboratory note books should be discouraged.

VETERINARY SCIENCE (200 Marks) Professor Sir John McFadyean, M B.

With one or two exceptions the candidates possessed a satisfactory knowledge of the subject.

7. The thanks of the Board are again due to the authorities of the University of Leeds, for their liberality and courtesy in placing the Large Hall and other rooms of the University at the Board's disposal for the Examination; and to the Examiners, for the care and attention they bestowed upon the written answers to the papers set, and upon the *vivâ voce* examination.

J. MARSHALL DUGDALE, *Chairman.*

THOMAS MCROW, *Secretary.*

16 Bedford Square, London, W.C.1.
May, 1917

II.—REPORT ON THE RESULTS OF THE TWENTY-SECOND EXAMINATION FOR THE NATIONAL DIPLOMA IN DAIRYING, 1917.

1. The Twenty-second Annual Examination for the National Diploma in the Science and Practice of Dairying took place in September, 1917. The Examination was held for English candidates at the University College and British Dairy Institute, Reading, from September 15 to 20; and for Scottish candidates at the Dairy School for Scotland at Kilmarnock, from September 22 to 28.

2. Fourteen candidates presented themselves at the English Centre, and of these the following nine satisfied the Examiners, and have, therefore, been awarded the National Diploma in the Science and Practice of Dairying:—

Kathleen Carnley, Midland Agricultural and Dairy College Kingston, Derby
Ada Jackson, Lancs County Council Dairy School Hutton Preston
E[illegible]ie Elizabeth Jones, Lancs County Council Dairy School Hutton, Preston, and University College and British Dairy Institute, Reading
Mary Ceinwen Jones, University College and British Dairy Institute, Reading
Thomas Duncan Potter, University College and British Dairy Institute, Reading
Mary Louise Roberts, University College of Wales, Aberystwyth, and University College and British Dairy Institute, Reading
Florence Robinson, Midland Agricultural and Dairy College, Kingston, Derby
Phyllis Mary Graham Tucker, University College and British Dairy Institute Reading
William Woodall, Midland Agricultural and Dairy College, Kingston, Derby

3. At the Scottish Centre, twenty-one candidates were examined, and of these the ten whose names and addresses are given below gained the Diploma:—

Bessie M S Armstrong, Bighouse, Melvich, Thurso
Mary Bannatyne Ledaig, Benderloch, Argyllshire
Margaret I Fletcher, Westbury House, Westbury-sub-Mendip, Wells, Somerset
Hope Cowan Hamilton, Rossarden, Glengarnock, Ayrshire.
Ormonde L. Kilgour, 72 Hamilton Place, Aberdeen
Margaret M. Macleod, 77 Kenneth Street, Stornoway
Margaret Ellen Munro, Tigh-na-Rothaich Peare, Strathpeffer
Catherine Vera Speirs, 13, Viewforth Terrace, Edinburgh
Isabella R Will, Acrehead, Dumfries
Helena G Williamson, Gordon Arms Hotel, Inverurie

Mr. J. F. Blackshaw, who conducted at both centres the Examinations in General Dairying, in Practical Butter-making, and in capacity for imparting instruction, reports that "The candidates presenting themselves at both the English and Scottish Centres satisfied me that they were earnest workers possessing a good share of natural ability.

"Their written and oral examination work was not satisfactory however. There was considerable evidence of incomplete preparation, and this, more than anything else, accounted for the somewhat high proportion of failures in this subject.

"The work accomplished by the candidates would seem to indicate that the existing provision for giving a higher training in dairying is not entirely satisfactory.

"The impression conveyed throughout the Examination was that the teaching had been too greatly divorced from practical conditions, and that the candidates had not command of sufficient scientific and practical facts to enable them to grapple with questions somewhat off the beaten track, yet capable of being satisfactorily answered by any one able to reason from scientific knowledge and genuine experience.

"Dairy-farming in this country has now developed to such an extent as would seem to demand a better provision for higher training than at present exists, and in view of the importance of the industry in relation to the Food Supply, the subject seems to be one which is deserving of prompt consideration."

The Examiner in Cheese-making, Mr. John Benson, reports that "Most of the candidates did exceedingly well in the practical work this year. The candidates at Kilmarnock were particularly good and made some very fine cheeses.

"The milk provided at Reading was in a forward stage of ripeness and tested to the utmost the skill of the candidates. In two or three cases the candidates were not quite equal to the task, but most of them made up the milk provided into cheese of very good quality. I am quite satisfied that generally the candidates had been well trained.

"In the written and oral examination the answers given were on the whole fairly good but not quite equal to those of recent years. Many were weak on the financial aspect of dairying and in the keeping of dairy accounts. The questions dealing directly with the manufacture of cheese were, however, answered in a very satisfactory manner, which assisted in raising the general average of marks obtained by candidates. Altogether the results were better than I had hoped for."

Dr. Tocher, the Examiner in Chemistry and Bacteriology, reports that "This year he examined fourteen candidates in Chemistry and Bacteriology at the Reading Centre. Of this number four wrote good papers and made an excellent appearance at the *vivâ voce* examination. The knowledge exhibited by six of the candidates was sufficiently above the minimum requirements to be classed as belonging to the fair standard. The answers to questions bearing on dairy bacteriology were clear and precise. Candidates were not so well prepared in general bacteriology and chemistry.

"Twenty candidates were examined at the Kilmarnock Centre. Of these, three had a very full knowledge of bacteriology and chemistry as applied to dairying; six attained the "fair" standard; while nine were able to secure marks placing them in the category of those who manage to meet the minimum requirements of the examination. The answers to written questions were not so full nor so good as the answers given by candidates at the Reading Centre. The proficiency shown at the oral examinations was practically of the same degree at both centres.

"The majority of the candidates showed a lack of preparedness in their answers to questions in elementary chemistry. A sound knowledge, however, of the applications of bacteriology and chemistry to dairying operations was general among the great majority of the candidates. Over the whole examination 21 per cent. of the candidates could be classed according to their degree of proficiency as good; 35 per cent. as fair; 32 per cent. as passable; while 12 per cent. were below the pass standard."

J. MARSHALL DUGDALE,
Chairman.

16 Bedford Square, London W C
October, 1917

ANNUAL REPORT FOR 1917 OF THE PRINCIPAL OF THE ROYAL VETERINARY COLLEGE.

ANTHRAX.

THE following Table shows, with regard to this disease, the number of confirmed outbreaks and of animals attacked during each of the last seven years :—

Year	Outbreaks	Animals attacked
1911	907	1,120
1912	743	840
1913	594	652
1914	722	79[illegible]
1915	575	642
1916	571	687
1917	421	480

As will be seen from the Table, the number of outbreaks confirmed during the past year is substantially smaller than the number for the preceding year, and less than half the number confirmed in 1911. One has indeed to go back for about twenty years to find a year in which the reported or confirmed outbreaks were so few. It must be noted, however, that it is impossible to measure the incidence of the disease by comparison of the annual number of outbreaks since the disease was first scheduled, owing to the fact that since 1st January, 1911, when the present Anthrax Order came into operation, the only outbreaks which appear in the official returns are *confirmed* outbreaks, whereas for the years between 1887 and 1910 inclusive the outbreaks given were *reported* outbreaks. In this earlier period the Board of Agriculture accepted as correct any case of anthrax diagnosed and reported as such by a Veterinary Inspector of the Local Authority, and it is unquestionable that in a large proportion of cases the diagnosis was erroneous. Since 1911 a reported outbreak does not figure in the returns unless the provisional diagnosis made by the local veterinary inspector has been confirmed by microscopic examination, supplemented, when necessary, by experimental inoculation carried out by experts in the Board's Veterinary Laboratory. The introduction of this method of diagnosis caused the outbreaks to drop from 1496 in 1910 to 908 in the following year. How very necessary this alteration was may be inferred from the fact mentioned in the Report of the Board's Chief Veterinary Officer that in 1916 reports were received of no fewer than 2,567 suspected outbreaks, of which only 560 were confirmed.

Another circumstance which makes the statistics with regard to outbreaks unreliable as a guide to the incidence of the disease since 1887, is that in all probability the obligation of owners to notify suspected cases was more frequently ignored in the earlier years than it is now. It is scarcely open to doubt that this is the explanation of the fact that during the first six years after the disease was made notifiable the annual outbreaks never reached 300. But, however that may be, the fact remains that except for the period embraced in the preceding Table a comparison of one year with another would be useless. Fortunately this period is already sufficiently long to show what one may expect from the continued operation of the measures now enforced in dealing with outbreaks. The returns for this period, and especially for the last three years, indicate that the disease is, so to speak, well in hand, but also that there is no prospect of its complete eradication.

As has been pointed out in previous annual reports, anthrax occupies a peculiar position among the scheduled contagious diseases, in that it falls far behind the others in respect of its tendency to spread by simple contact. On this account it is easy to devise measures to bring outbreaks to an end, provided notification of the first case is promptly given · and that the existing Order is generally effectual in that regard is shown by the fact that in no year included in the Table did the average number of animals which contracted the disease in an outbreak reach two.

The measures now enforced also appear to be generally successful in bringing about the actual eradication of the disease at the place where it is diagnosed, though that fact is not deducible from the published returns. It emerges very clearly, however, from the information collected by the Board of Agriculture, and published in the chief Veterinary Officer's reports, which shows that in more than 70 per cent. of the outbreaks in 1916 there was no history of a previous outbreak on the same farm or premises.

It has previously been suggested in annual reports that the disease is mainly kept up by means of anthrax spores present in hides, artificial manures, and feeding stuffs, imported from countries in which anthrax is a common disease. For the most part contagion in the ordinary sense of the word appears to have very little to do with the occurrence of the disease in this country. It is probable that the smaller number of outbreaks during the past year is the direct result of the reduction in the amounts of the imported materials mentioned above. Indeed, it may be said that the war is providing a test which will show whether the view that the majority of the cases of anthrax in this country are exotic in origin is correct or not.

It would be a great mistake, however, to overlook the fact that neglect of the proper precautions in dealing with a case of anthrax may permit the disease to establish itself more or less firmly on the place, with the result that, without the introduction of any fresh virus from an outside source, other outbreaks may occur at intervals, even for a good many years. It is this possibility which makes it incumbent upon the owner of a suspected case of anthrax to give the earliest possible notice to the local authority.

GLANDERS.

The following Table shows the incidence of this disease during the last seven years:—

Year		Outbreaks		Animals attacked
1911	...	209	...	504
1912		172		315
1913		162		447
1914		97		286
1915		50		87
1916		47		117
1917		24		62

The figures for the past year must be regarded as very satisfactory, since they show that the reduction in the number of outbreaks and of animals attacked, which suffered a check in the previous year, has been resumed. The present position with regard to glanders is indeed far more gratifying than would appear from the Table, for the most rapid reduction in the number of outbreaks occurred in the period preceding the one for which the figures have been given. As late as 1904 the annual outbreaks were 1,529, with 2,658 animals attacked, and throughout the period 1900–1906 they were always over 1,000. The present Glanders Order came into force in 1908, and during the following year they fell to 533.

The efficacy of this Order depends upon the fact that it indirectly compels the owner of a horse in which glanders has been detected to allow all the apparently healthy horses in the same stable to be subjected to the mallein test, and obliges the local authority to slaughter the reacting animals and to compensate the owner.

Having regard to the large number of horses in this country, it may be said that glanders has now been reduced to a position which deprives it of any economic importance, and it may reasonably be hoped that it will, before many years, be finally stamped out. It must be recognised, however, that circumstances arising out of the war may help to keep the disease alive. The figures which have been given for the past year do not include cases of glanders which have occurred among Army horses, and it is well known that many such cases have been detected among imported animals since the war began. Although very vigorous measures are employed to deal with the disease in the Army, the occurrence of such cases involves some risk that it may be spread to the general equine stock of the country. In view of this danger, the reduction in the number of outbreaks during the past year becomes still more gratifying. But the chief danger in this connection will arise after the war, when large numbers of Army horses will be brought back to this country. In earlier times a great extension of the disease from this cause would have been inevitable, but with adequate precautions, of which careful testing of returned horses with mallein will be the most important, it may confidently be expected that such a result will be averted.

SHEEP SCAB.

The following Table shows the number of reported outbreaks for the past seven years :—

Year	Outbreaks
1911	434
1912	301
1913	236
1914	226
1915	257
1916	427
1917	543

The figures for the past year, and indeed for the whole period included in the Table, are unsatisfactory and disappointing, not because of the small increase in outbreaks, but because they indicate failure of the measures which presumably were intended to give the country complete freedom from the disease. In fairness to these measures it ought to be remembered that between 1870 and 1904 the annual outbreaks were never under one thousand, and in some years over three thousand; and it must be admitted that the present position is therefore very good as compared with the state of affairs up to a dozen years ago. But flock-owners who have now for many years patiently submitted to the trouble and inconvenience of the sheep-dipping orders, in the expectation that they would eventually bring about the complete eradication of the disease, cannot be expected to be content with results that hold out no such promise. In previous annual reports it has been pointed out that the final eradication of the disease might not be obtainable with the measures that were conspicuously successful in reducing the number of outbreaks below the high level of the years prior to 1904, since the stamping out of the disease on the large sheep farms in Wales, the northern counties of England, and the Highlands of Scotland would present special difficulties. But it cannot be admitted that these difficulties are insuperable, or that the disease could not be stamped out except by measures that would be intolerable to sheep owners or impossible because of their cost.

SWINE FEVER.

The following Table shows the number of confirmed outbreaks of this disease during the past six years :—

Year		Outbreaks
1912	...	2,920
1913	...	2,573
1914	...	4,356
1915	...	3 994
1916	...	4,331
1917	...	2.104

The great reduction in the number of outbreaks which occurred during the past year must be considered very satisfactory. It is, indeed, far more satisfactory than might appear from the above figures, inasmuch as it has been achieved at a greatly reduced cost to the country, and in spite of some relaxation in the restrictions on the movement of pigs, which apart from the loss which they entail, have always been a great source of worry to owners. The subject is further dealt with at another part of this Volume (p. 34).

CONTAGIOUS ABORTION IN COWS.

Since this disease was dealt with in a special article (Journal R.A.S.E., Vol. 74, page 89) a good deal of experience has been gained in connection with the treatment of outbreaks, and it appears to be advisable to summarise it here.

Diagnosis.—In the final report of the Departmental Committee, which was published in 1910, it was stated that if contagious abortion were dealt with under an Order of the Board of Agriculture and Fisheries, the difficulty of diagnosis would probably not be greater than in the case of some of the diseases already dealt with under the Diseases of Animals Acts. It may now be stated with confidence that in none of what are commonly termed the scheduled contagious diseases of animals can a diagnosis on the live subject be made with the same certainty as in contagious bovine abortion.

During the past six years over seven thousand samples of blood from cows that had aborted, or from cattle suspected ot being affected with the disease, have been submitted to the agglutination test in the Research Laboratory at the College, and the opinion expressed in the preceding sentence is based on this experience.

It may, however, be advisable to state more precisely than by comparison with other diseases what is the margin of error when the diagnosis in a suspected case of contagious abortion is based on the result of an agglutination test. The error, obviously, may be in either of two directions: (1) interpretation of the result may condemn a healthy animal, or (2) it may exonerate a diseased one. As regards the first of these, it may without exaggeration be said that the test is free from error, or at least that the errors are so few as to be negligible in practice. In other words, when the blood serum of a suspected cow or other bovine animal causes distinct agglutination of abortion bacilli in a dilution of 1 in 50 the animal in question has been infected with contagious abortion.

On the other hand, the absence of any agglutinating effect cannot be accepted as conclusive proof of freedom from the disease, and although the possibility of errors in this direction has been established by actual experience in carrying out tests, it was foreseen and pointed out some years ago. The possibility arises from the fact that in this, as in all other contagious diseases, a certain time must elapse after actual infection before an animal can be expected to exhibit any characteristic symptom or react to any test which is distinctive for the disease in question. As is well known, the tuberculin and mallein tests are liable to errors of this kind.

On the ground of certain experiments it was until lately assumed that the outside period after actual infection during which an animal might fail to react to the agglutination test was about six weeks, and that it usually did not exceed a month Furthermore, it was assumed that actual abortion probably never occurred during this period, and therefore that the negative result of an agglutination test applied immediately after abortion warranted the conclusion that the abortion had been accidental, or at least not of the ordinary contagious kind. As the result of experience these opinions must be revised, and it must be admitted that the disease may cause abortion before the non-reacting period is ended.

It would occupy too much space to set out in detail the history of the cases which led to this conclusion, but it may be stated briefly that in a very few cases a cow has failed to react immediately after abortion, but has reacted a month later. It is probable that the errors which would be committed by regarding non-reaction to the test carried out immediately after abortion as proof that the case was not one of contagious abortion would be less than one per cent.

Methods of infection.—For many years infection *per vaginam* was generally regarded as the most common, but since the publication of the report of the Departmental Committee opinion has inclined to the view that in the great majority of cases the infective material enters the body by the mouth. Experience gained in carrying out repeated tests of the same animals throughout the year has strengthened this view, since it has shown that the disease may spread readily among animals at pasture, where direct infection of the genital organs from contaminated ground cannot be common.

It is true that this does not disprove the opinion that the bull is largely responsible for the spread of the disease, but that view has also been contradicted by evidence discovered in carrying out agglutination tests in infected herds. Such evidence was obtained by ascertaining the last date of service of cows which began to react during the course of repeated monthly tests. If the disease were frequently transmitted either directly or indirectly by the bull, one would expect to find that such first reactions generally occur within a month or two after the last service. Such, however, was not found to be the case, the first reactions occurring at all intervals after service, up to near full term. In accepting such late reactions as evidence disproving infection by the bull, it is assumed that what has been called the non-reacting period is generally under two months—a conclusion which appears to be fully justified by all the evidence at present existing.

But evidence of another kind has tended to discredit the opinion that the bull plays an important part in the infection of cows and heifers. In a number of cases a general test of the herd has disclosed the fact that one or more of the bulls had contracted the disease, and of course in such cases the owner has always been advised to discontinue the use of the infected bull, or to use him only for the service of cows known to be infected. Fortunately, however, in one instance such a bull was used for the service of healthy cows, and subsequent testing enabled one to discover what proportion of these became infected.

This bull was first tested in May, 1913, and the result then indicated that he was not affected with contagious abortion. He was next tested on November 7, 1913, and the reaction to the test was quite as strong as it usually is in an infected cow that has just aborted. He was tested on various occasions for two years afterwards, and always reacted without any falling off in the agglutinating power of his blood. It was afterwards ascertained that during the twelve months following November 7, 1913, when he was first found to be infected, he served nineteen cows. Of these, seventeen became pregnant, carried their calves to full term, and were found to be free from abortion by an agglutination test carried out subsequent to parturition. Of the two remaining cows, one was served in June, 1914, and aborted and reacted in October, 1914. The exact date of service of the remaining cow was not known, but it must have been in October, 1914, as she calved apparently at full term on July 10, 1915. She reacted for the first time in May, 1915.

Although two of the cows served by this bull during the period mentioned became infected, it does not at all follow that the disease was contracted at the time of service. In fact, the probabilities are strongly against that view, for half-yearly tests of the whole herd showed that during the same period a large number of cows served by healthy, non-reacting bulls became infected.

It is not maintained that the facts which have been stated above prove that an infected bull cannot transmit the disease in the act of service, but meanwhile they stand as valuable evidence in favour of the view that any such risk is very small, and there has not been published any other evidence of equal value pointing in the opposite direction.

The facts do not prove anything with regard to the possible transmission of the disease by a bull which with only a short interval serves first a diseased and then a healthy cow. That the disease is sometimes transmitted in that way is highly probable, and it need hardly be said that the common use of a bull for healthy and diseased cows should always be avoided.

Different Methods of Dealing with the Disease.—Three courses are open to an owner who discovers that a case of contagious abortion has occurred in his herd :—

(1) He may decide to sell or isolate the cow that has aborted, to disinfect the premises if the abortion has occurred in a house, and perhaps to carry out frequent disinfection of the hind quarters and genital passages of all the cows in the herd, according to the plan recommended by the late Professor Nocard.

(2) He may have the whole of his breeding animals tested by the agglutination test, and endeavour to eradicate the disease by isolating or selling for slaughter all the animals that react.

(3) He may decide to have the whole of his cows and heifers "vaccinated" against the disease.

(1) The first of these methods of dealing with the disease is foredoomed to failure. In all circumstances it is, of course, desirable that a cow which has aborted from contagious abortion should be put out of the herd temporarily or permanently, and it is also right to disinfect the place where a cow has aborted or has stood after abortion. Such precautions, however, will never succeed in stamping out the disease, except in the very rare case in which the cow that imports the disease into the

herd herself aborts before it has spread from her to other animals. In nearly all cases the method fails, because before the first cow aborts others have become infected. In this connection it is of the greatest importance to remember that, unless an agglutination test is carried out, the cow which brought the disease to the herd may never become an object of suspicion because she carries her calf to full term in spite of the fact that she was infected and capable of passing the infection on to previously healthy cows. It follows that the removal of the cows that have actually aborted in most cases still leaves other infected cows in the herd, and when several cases have already aborted before any precautions are taken that result is a dead certainty.

With regard to the attempt to control the disease by applying disinfectants to the healthy cows, it need only be said that it is probably of no value whatever, and that it involves a useless irritation of the animals.

(2) The second method of dealing with the disease is almost exactly analogous to the one which has now for a good many years been employed in freeing herds from tuberculosis. Fortunately, however, the problem presents less difficulty in the case of contagious abortion. The principle in both cases is to rely upon a diagnostic test to show what animals have already contracted the disease, and to remove these from the herd.

The immediate adoption of this method of dealing with the disease cannot be recommended in every case. Thus, it may immediately be put aside in outbreaks that have already been running for some considerable time. If, for example, cases of abortion have been occurring at intervals for a year or more it may be accepted as almost certain that the disease has spread to a large proportion of the cows, and that its eradication by testing and isolation will be impracticable owing to lack of the necessary premises, and also, in the case of valuable pedigree stocks, impossible owing to the great sacrifice which the sale of animals for butchers' purposes would involve. It is also in general an impracticable method in purely milking herds, in which numbers of cows are always being sold and replaced by new purchases.

There is no doubt, however, that in other herds and in other circumstances this is the method that owners should be advised to adopt. There is now experience to show that by proceeding in this way outbreaks can be stamped out more quickly and with less loss than by any other means. It cannot be too strongly emphasised that if the first case of abortion in every previously healthy herd were regarded seriously, and not passed over as being the result of some accident, contagious abortion would soon cease to be a serious disease. In every such case an agglutination test should be employed to show whether the cow in question has been infected with contagious abortion or not. If not, no precautions are necessary in connection with the animal, and the owner's mind is immediately set at rest. If, on the other hand, the test shows that the abortion has been of the contagious kind, it is desirable to carry out without delay a general test of the whole herd. In fortunate cases this may show that not more than one or two of the other cows are already infected. Even when a larger proportion is found to be diseased in a valuable herd it will obviously be worth while to make a considerable initial sacrifice to obtain immediate freedom from the disease, or to go to considerable expense in maintaining the reacting animals in complete isolation for a time with the same object.

If, however, the preliminary general test of the whole herd shows that a very large proportion of its members are already infected, it is probably not worth while to attempt to deal with the disease by this method, and it may be better to adopt immediately the third method.

(3) It is very important that owners should realise exactly what is the nature of the so-called "vaccination" of cattle against contagious abortion. The term "vaccination" is generally restricted to operations in which one endeavours to confer immunity against a particular disease by inoculating animals with what is termed a modified virus, that is to say, by introducing into their bodies the actual bacterium or cause of the disease after it has by some means or other been to a large extent robbed of its natural virulence. In vaccination against contagious abortion what is employed is an artificial culture of the unmodified abortion bacilli—the bacilli which, if given by the mouth or injected into the genital passages, would be very likely to cause abortion, and which would be certain to do so if injected in any considerable numbers into the blood. The abortion bacillus occupies a rather remarkable position among the disease-producing organisms, in that it seems scarcely able to produce any disturbance of the general health, even in pregnant cows; and when introduced into the bodies of non-pregnant animals appears to have no effect whatever, in spite of the fact that actual infection results, as can be proved by carrying out the agglutination test a short time afterwards. The idea which underlies the method of vaccination against abortion is that if cows while non-pregnant are inoculated with a large dose of abortion bacilli under the skin they will become infected but recover in a few months, and thereby have acquired a valuable degree of immunity against the disease.

The method is troublesome to carry out because the inoculation cannot be practised on cows or heifers that are already in-calf, and also because it is not safe to put inoculated cows or heifers to the bull in a shorter period than two or three months after inoculation. Apart from these objections, it must be said that this method of dealing with the disease is not one that can be lightly advised in the case of valuable pedigree herds. Since, in spite of its name, the method is really one of intentional infection with the disease which is termed contagious abortion, it would be madness to employ it in a healthy herd. Even in a herd already infected it should not be adopted unless the previously described method of eliminating the disease appears to be impracticable.

A further objection to inoculation is that for two or three years afterwards the herd must be regarded as an infected one, and an owner could hardly with a clear conscience sell an animal from it without disclosing the facts. It must also be noted that, although it is not necessary to inoculate cows a second time, it is absolutely necessary to inoculate any heifers or other cows that are to be brought into the herd during the following year, and perhaps even during the second year.

It can hardly be said that there has yet been provided sufficient evidence to show to what extent this method is successful in reducing the number of cases of abortion, or how long it may take to eradicate the disease from a herd. The figures which have already been published, however, would appear to prove that it is much better to adopt this method than to allow the disease to run its course, or to rely upon disinfection and the selling of cows that have aborted to check the disease.

It is very natural that in connection with the subject of contagious abortion methods of cure or eradication attract most attention, especially since there is no denying that a very large proportion of the herds in the country are already infected. It may, however, be reasonably hoped that the great majority of herds, and especially of the valuable pedigree herds, are still free from the disease, and for the owners of all such herds the question of the greatest importance obviously is how to keep their animals healthy. Fortunately the question how this can be effected is one to which a very precise answer can be given. It is that the introduction of the disease into a healthy herd can only be prevented by taking steps to ensure that any newly purchased animal is free from the disease. When the purchaser has information satisfying him that the herd from which the newly purchased animal comes is free from contagious abortion there is, of course, no need to seek for other evidence. But in all other circumstances the animal should not be admitted to the herd until a test of its blood has indicated that it is free from contagious abortion. If this were adopted as a rule a great check on the further spread of the disease would be imposed. Without this precaution every new purchase involves a very serious risk to the owner of a healthy herd.

The next best thing to adopting such a practice is to regard any case of abortion which occurs in a previously healthy herd as one of contagious abortion until the contrary has been proved by a test of the animal's blood.

ABORTION IN MARES AND JOINT-ILL IN FOALS.

Although the pressing importance of researches regarding these two diseases has been recognised for some years, yet, owing to the amount and character of the research work already on hand at the Royal Veterinary College, it was not possible to undertake any serious investigation regarding them until October, 1916.

Towards the end of the previous foaling season an opportunity to make a post-mortem examination in the case of a few foals that had been prematurely born was afforded, and the information thus obtained suggested that in this country abortion in mares, if not also joint-ill in foals, was caused by a small bacillus which had on a number of occasions within recent years been recognised to be the cause of contagious abortion in the United States of America, Canada, and some European countries.

A preliminary report regarding these investigations has already been published,[1] but in the meantime it appears to be desirable to give here a summary of the results which have been obtained, especially as it is earnestly desired to bring the facts to the notice of breeders before next foaling season.

The observations which have already been made leave no doubt that in this country the common cause of abortion in mares, and possibly the exclusive cause of what may be termed outbreaks of abortion in these animals, is the micro-organism referred to above. This organism is a small bacillus not distinguishable from a number of other bacteria by what are commonly termed morphological characters, that is to say, by size or shape. Fortunately, however, it has some very distinctive cultural characters, by which, according to present knowledge, it can be identified with little risk of error.

This organism is not only the common cause of abortion, but apparently also the almost exclusive cause of joint-ill in foals. It appears to be always more or less abundantly present in the bodies of aborted fœtuses, and it has been found *not only in the intestine and other internal organs, but also* in the joint cavities of foals that have been carried to nearly full term. Moreover, in all the cases of joint-ill which it has been possible to examine post mortem the same organism has been found in the diseased joints, and in other lesions in the lungs and mesenteric glands, and in every case examined save two the organism in the joints was unaccompanied by any other.

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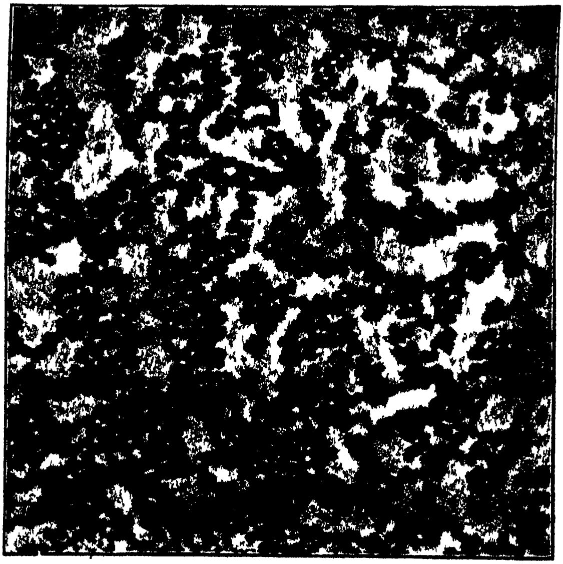
[1] "Contagious Abortion in Mares and Joint-ill in foals," by Sir John McFadyean and Capt. J. T. Edwards. *Journal of Comparative Pathology and Therapeutics*, Part IV., 1917, p 321

The frequency with which this organism is present in a state of purity in the diseased joints furnishes very strong evidence that it is the actual cause of the disease, and what has been observed with regard to its pathogenic properties when artificially cultivated and injected into horses leaves no doubt that it is responsible for the actual joint disease. Even small doses of an artificial culture of the bacillus when injected under the skin of an adult horse cause intense inflammation and swelling, and when introduced into the blood stream serious illness and even death may result.



Micro-photograph of the bacillus of abortion in mares and joint-ill in foals.
(Magnified 1,500)

As soon as the investigations had led to the conclusion that this particular organism was actually the cause of both contagious abortion and joint-ill it was resolved to concentrate efforts on an endeavour to obtain a protective serum for the treatment or prevention of cases of joint-ill during the ensuing foaling season. It may here be said that so-called anti-joint-ill serum has been manufactured and sold for use, both in this country and in the United States, during recent years, but it is well known that such serum was prepared from streptococci, on the improved assumption that organisms of that class were the usual cause both of abortion in mares and of joint-ill in foals. The employment of serum of that kind must now be discarded, as no serum can be expected to be of any real value for the cure or prevention of any disease unless it is prepared by the use of the specific organism which is the cause of the disease in question.

Unfortunately, owing to the intense virulence of the bacillus of joint-ill for horses, the speedy manufacture of an anti-serum was found to be attended with great difficulty, and a number of the horses which were first used died at an early stage in the attempt to immunise them. In a few cases, however, the process of hyper-immunising was successfully carried through, and sufficient serum for the treatment of over 500 foals was ready for use during the period March to June last. This serum was supplied gratis, either direct to owners or to veterinary surgeons who were willing to accept it on condition that full information regarding the results of its use was duly furnished Another condition attached to the giving away of the serum was that foals receiving the serum were not to be treated in any other way.

It is much to be regretted that in a good many cases those who received the serum and used it failed to send information of any value as to the results obtained, but in over 200 cases the particulars asked for were eventually supplied.

The number of foals affected before they were treated with this serum was 192, and of these 111 died, and 81 made a good recovery. These figures may not appear to be very satisfactory, but in fact the results of the serum treatment were considered good by nearly all the veterinary surgeons who used it. In judging of the value of the serum, it has to be remembered that joint-ill in foals is a disease which under all methods of treatment hitherto tried has had a very high mortality. It has also to be remembered that probably in most cases the foals are actually born infected, and that at birth their joints and bodies have, so to speak, been so overrun by the bacilli which are the cause of the disease that any remedy, and certainly any other remedy than the appropriate anti-serum, is almost hopeless.

At present the best available standard by which to judge the value of any new treatment of joint-ill is the past experience of veterinary surgeons in the use of other remedies, and, judged by this standard, the new serum appears to be promising.

It was naturally desired to use the limited amount of serum available mainly for the treatment of actually diseased foals, but in a number of instances it was allowed to be used immediately after birth, as a preventive, on foals that appeared to be healthy. The reported results of this preventive treatment were very satisfactory, but the total number of foals treated in that way was too small to warrant any firm conclusion.

Arrangements have been made with a view to providing a much larger supply of serum for next foaling season, and, as before, this will be supplied without charge to veterinary surgeons who will undertake to keep a careful record, and eventually furnish reports regarding the result of the treatment in each case

In the meantime, members of the Society who have cases of abortion in mares should communicate with the Principal of the College, remembering that, according to the existing evidence, abortion in these animals and attacks of joint-ill in foals are, broadly speaking, the same disease, and that precautions taken in a stud when the first case of abortion occurs may not only prevent further cases of the same kind, but also obviate losses from joint-ill in the foals that are carried to full term.

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ANNUAL REPORT FOR 1917 OF THE CONSULTING CHEMIST.

ANOTHER year has brought about no improvement in the conditions which have rendered the work of the Chemical Department one of so much difficulty and concern. Indeed, these difficulties have been intensified, rather than otherwise, by the shortening of supplies of fertilisers and feeding stuffs, the greatly increased prices of the same, and, more recently, through the intervention of Government in respect of supply and prices.

There is cause for satisfaction, accordingly, that, notwithstanding these drawbacks, the number of samples sent by members to the Society's laboratory shows an increase of about fifty over those sent in 1916, thus coming back to the figures of 1915 (300), the actual number being 311. No Country Show of the Society having been held in 1917, there were no samples of milk or of cider and perry analysed in this connection.

The detailed list is given at the close of this report, the most striking feature being the increase in the samples of sulphate of ammonia analysed, and also of soils. The increase in the first-named was due, no doubt, to the Government regulation of the supply and price of sulphate of ammonia, which, throughout the year, has been practically the one nitrogenous manure readily available ; while the breaking up of grass land to arable, and the very proper desire to increase the corn production of the country, have led to more inquiry than usual as to the capabilities of land and how to improve these.

The rise in prices, both of fertilisers and feeding stuffs, which was noted in last year's report, has been intensified, and the scarcity of supplies, due to shortage of shipping facilities and submarine risks, has been very severely felt. The Government came to see that it was no use urging the farmer to produce more corn if the latter could not get the manure needed for his crops, and so, after a time, they saw the wisdom of releasing a certain proportion of the sulphuric acid (oil of vitriol) that had been commandeered for munition purposes, and allowed the manufacturers of artificial manures to use it more freely. The fact, however, that we in this country are entirely dependent on foreign countries for the supply of phosphatic rock (which is the base of superphosphate), made it very difficult to procure the raw material, and the supply of this has, in turn, been taken over and regulated by Government. The same has been done with sulphate of ammonia—a product obtained from gas works, shale works, coke ovens, &c.—and the price at which it is sold to the farmer has also been fixed. Still later, oil cakes and certain other feeding materials have been similarly controlled, and the prices fixed.

The consequence has been to limit greatly the class of materials which the farmer has to draw upon, and it may be broadly said that, in the way of fertilisers, purchases have been in the main confined to superphosphate and basic slag among phosphatic fertilisers, and to sulphate of ammonia among nitrogenous ones. The rivalry between sulphate of ammonia and nitrate of soda has, for the time, disappeared, and cyanamide and nitrate of lime are but little heard of. Refuse materials, lime, shoddy, wool-waste, &c., continue, however, to be used for special purposes.

The efforts put forward to induce superphosphate makers to utilise the "nitre-cake" obtained as a waste product in nitric acid manufacture, as a means of supplementing the limited supply of oil of vitriol (nitre cake itself containing some 30 per cent. or so of free sulphuric acid), have been in no way successful. The mechanical difficulties encountered in the manufacture have been hard to get over, and the production of a low-class superphosphate—or "war-time superphosphate"—has now been practically abandoned. For basic slag there has been an unprecedented demand, and the supplies have fallen far below the requirements. On this account the question of making use of slags produced by the "open-hearth" process has been revived, and, seeing that the main factor against the utilisation of these slags consists in their not showing a "high solubility" under the "citric acid test," there is every reason for justifying such action. As I have frequently pointed out, the "citric acid test" is one "imported from Germany," and has been exploited for commercial reasons mainly, but without carrying with it that correspondence in actual field results which it should have established if it is to figure as the real test of relative value.

Bones have been both scarce and very dear, and Peruvian guano, fish and meat guanos, &c., are only occasionally met with now.

For lime, and materials containing it, there has been an increased demand, and probably because of the need of paying more attention to the improvement of land. Few practices of the older times were so beneficial as that of liming, and, unquestionably, the land of the country has in many parts suffered greatly from the abandonment of this good practice.

The search for materials supplying potash has continued, and a somewhat hopeful source has been discovered in the "flue dust" or deposit that accumulates in the flues of furnaces used for the smelting of certain iron ores, as also in cement kilns, this dust being found to contain not inappreciable amounts of potash. Instances of these are given later.

The difficulties experienced in obtaining supplies of feeding stuffs have been none less than with fertilisers. Here, again, the fact that we have always been so dependent upon foreign supplies, and, more recently, the necessary imposition of regulations to conserve home-grown grain for human support and not to give it to stock, have made the task of the stock-feeder a very arduous one. As mentioned, something has been done of late by Government in the way of controlling prices. The scarcity referred to has induced the use, for feeding purposes, of a number of materials which ordinarily would hardly have been employed, such as flax bols, clover-seed hulls, &c., some of which are referred to later.

A few samples of sugar-beet have been analysed, but the very desirable extension of this cultivation has practically been checked entirely, and once again we see, in the lamentable shortage of our sugar supply, the folly of previous Governments in doing nothing to stimulate the production of sugar in this country, where it might have succeeded so well and have rendered us now independent of foreign supplies.

The scarcity of fertilisers and feeding stuffs has been marked by still further rises in prices than those mentioned a year ago. Superphosphate, which in pre-war times cost about 3*l.* a ton, has now gone up to 6*l.* for 26 o/c., and 6*l.* 10*s.* for 30 o/c. (Government prices), with further advances to come in 1918. Basic Slag has not proportionately increased so much, but is also much dearer, viz., 3*l.* 10*s.* to 4*l.* a ton. Bone meal, 7*l.* 10*s.* a ton in 1916, cannot now be got under 10*l.* 10*s.*, or even 12*l.* at times. Nitrate of soda is, to the agriculturist, practically unprocurable, and the one redeeming feature is the keeping down, by Government action, of the price of sulphate of ammonia to 15*l.* 15*s.* a ton.

Among feeding stuffs, linseed cake and cotton cake have become alike scarce and dear, the respective 15*l.* and 12*l.* per ton prices of 1916 rising in 1917 to 22*l.* and 16*l.* In ground-nut (earth-nut) and palm-nut cake, with prices not so markedly raised, some relief has been found, though supplies are still short. Dried grains have experienced a rise from 10*l.* (1916) to 17*l.* or more per ton, and other feeding materials have shown somewhat like increase.

Altogether, though the farmer may have had some encouragement in the more assured price for grain, and in the control of prices of certain fertilisers, his difficulties, and more especially those of the stock-farmer, have not had much alleviation.

These are hardly times in which one can look for any amendment of the Fertilisers and Feeding Stuffs Act, but continued experience of its working has brought out more and more instances of the need of amendment, and these have been reported from time to time to the Council of the Society. The most recent is that in which it has been pointed out that, when an order is given, an invoice may be sent at once, but if the goods are not delivered within three months of that time (as has frequently happened this year), no prosecution for breach of the Act can be undertaken, the clause "whichever be later" (referring to delivery of invoice and of goods) being omitted in the section that governs any action.

Coming, lastly, to matters more directly connected with the Council's operations, mention may be made of the extremely valuable and practical conclusions of the War Emergency Committee, some of which had to do with the supply and sale of fertilisers and feeding stuffs. Also of the issue of "Occasional Notes"—a leaflet issued as occasion serves and supplying information which should be given promptly and without waiting for the next issue of the Journal. To these Notes the Chemical Department has liberally contributed. At the Woburn Experimental Farm a further development of the interesting series of experiments on calf-rearing has been undertaken, the main object being to see how the use of milk (now so much needed for human sustenance) could be dispensed with in cattle-rearing. Also an experiment conducted at Woburn on the respective amounts of manure produced by the consumption of cake, hay, and other bulky foods, had important bearings on the practice of valuation of hay consumed on, or removed from, the farms in certain of the northern districts. The results obtained formed the subject of a paper read before the Central Association of Agricultural Valuers, and this, after publication by the Association, resulted, in one case at least, in a revision of the existing practice.

Following my usual plan, I now mention matters of interest which have arisen from the examination of samples sent to me by Members of the Society, and, at the close, a list of the different samples analysed is given.

A. Feeding Stuffs.

1. *Linseed Cake.*

Of the eleven samples sent, all were pure except one, which contained a considerable quantity of castor oil bean. This had been purchased as "Bombay Linseed Cake," and was guaranteed pure. Cows that were fed on it scoured and were seriously ill, though, under a veterinary surgeon's care, they eventually recovered.

As showing the different qualities of linseed cake which may still be met with, the following analyses are given :—

	A	B
Moisture	12·77	10·15
Oil	13·52	5·26
Albuminoids	27·87	34·87
Carbohydrates, &c.	39·73	44·25
[1]**Mineral matter**	6·11	5·47
	100·00	100·00
Nitrogen	4·46	5·58
[1]**Including sand**	1·14	·45

"A" was a pure and rich cake. "B" was of American make, and dreadfully hard, almost like paving stones. Notwithstanding this, the price charged for it, in November, 1917, was 22*l.* 2*s.* per ton, the price of the best quality cake.

2. *Cotton Cake.*

An exceptionally high quality cake was the following, guaranteed to contain oil 5 per cent., albuminoids 22 per cent. :—

	Per cent.
Moisture	12·04
Oil	6·83
Albuminoids	26·75
Soluble carbohydrates, &c.	29·74
Woody fibre	19·75
[1]Mineral matter	4·89
	100·00
Nitrogen	4·28
[1]Including sand	·25

3. *Cooked Decorticated Cotton Seed Meal.*

In my last Annual Report I gave an instance of a material sold under this name but consisting of damaged seed, subsequently cooked, and salt added to it to preserve it Another such example occurred this year. It cost 12*l.* per ton, and was guaranteed to contain oil 9 per cent., albuminoids 30 per cent. The analysis gave :—

	Per cent
Moisture	13·84
Oil	9·40
Albuminoids	29·06
Soluble carbohydrates, &c.	20·50
Woody fibre	12·52
[1]Mineral matter	14·68
	100·00
Nitrogen	4·65
[1]Including sand	·30
" common salt	11·40

The salt amounted to 2 oz. to the lb., and this quantity, for some classes of stock, is highly objectionable beyond the fact that one does not want to buy salt at cotton-cake price. The material was in unsound condition, and the high percentage of woody fibre shows that the seed was very badly decorticated. The meal was sent back to the vendors by the purchaser.

4. *Rice Husk sold as Rice Meal.*

A Member of the Society bought in Oxford a ton of what was sold to him as "Rice Meal" at 15*l.* per ton in January, 1917. On giving it to his young pigs ten of them died.

On analysing a sample I found it to give :—

	Per cent.
Moisture	9·63
Oil	5·35
Albuminoids	6·75
Soluble carbohydrates, &c.	34·57
Woody fibre	28·74
[1]Mineral matter	14·96
	100·00
Nitrogen	1·08
[1]Including silica	11·47

This is not the analysis of genuine rice meal at all, and further examination showed it to be composed mainly of the outer husks or "shudes" of the rice grain, and these, being very rough and gritty, are very likely to produce inflammation, especially in the case of young pigs.

5. *Miscellaneous Materials used for Feeding Purposes.*

(*a*) Flax Bols.
(*b*) Cacao Shells.
(*c*) Glucose Residue.

Owing to the short supply of feeding materials, a number of products which, under ordinary circumstances, might not have been used, have been pressed into service. The following are examples :—

		Flax Bols		Cacao Shells
	(1)	(2)	(3)	(4)
Moisture	9·07	12·98	13·86	10·86
Oil	19·90	17·47	3·12	3·15
Albuminoids	14·56	13·62	7 00	14·50
Soluble carbohydrates, &c.	26·77	23 24	31·83	46·49
Woody fibre	21·13	12·29	36·77	18·33
[1]Mineral matter	8·57	20·40	7·42	6·67
	100·00	100·00	100·00	100·00
Nitrogen	2·33	2·18	1·12	2·32
[1]Including sand and silica	3·69	13·93	1·39	·54

	Glucose Residue (5)
Water	33·67
Organic matter	26 00
[1]Mineral matter	40·33
	100·00
Nitrogen	·43
[1]Including sulphuric acid	22·62
equal to sulphate of lime	38·45

Flax Bols [(1) (2) (3)] are, I am informed, the seed cases of flax separated from the plant previous to steeping for fibre. They are then kiln-dried and ground into meal for feeding use. The analyses show that these are of variable quality ; (1), obtainable in the North of Ireland, cost 13*l.* 10*s.* a ton, which is beyond their value ; (2) and (3) came from the same sender (Ireland) ; (2) had a very excessive amount of sand and dirt, and, though this could to some extent be shaken out of the sample, its presence is objectionable ; (3) was much cleaner, though of lower quality, and it cost 7*l.* a ton.

The Cacao shells (4) cost 7*l.* a ton, and are worth trying, though the price is above their value. In quality this sample was inferior to one given in last year's Annual Report, and which showed 11·35 per cent. of fat (oil).

(5) was evidently a refuse material obtained in the manufacture of glucose (maize starch treated with sulphuric acid). It was intensely acid, and, although costing only 2*l.* a ton, was a quite unsuitable material for food, especially for pigs. The mineral matter consisted largely of sulphate of lime, the result of partly neutralising the free sulphuric acid with lime. It soon turned mouldy on keeping.

B. FERTILISERS.

1. "*War-time Superphosphate.*"

Little or no success, as already stated, has attended the manufacture of this material. A sample sent me gave :—

	Per cent
Soluble phosphate . . .	14·81
Insoluble phosphates . .	4·44
Moisture	11 91

This was rather lumpy, but not wet ; it had been guaranteed "23 per cent. of phosphates" ; price, 95*s.* per ton in June, 1917. It is well to point out that a guarantee such as this leaves it quite open as to whether the phosphate guaranteed is "soluble" or if it is "total" phosphate—a material point.

2. *Basic Slag.*

In order to comply with trade practice, the Instructions to Purchasers, issued to members of the Royal Agricultural Society of England, were amended in regard to basic slag, and now include a statement of the amount of "citric soluble" phosphate as well as of "total" phosphate. They now read :—

> "**Basic Slag to be guaranteed to contain a certain percentage of Total phosphates or of 'Citric soluble' phosphates (*i.e.*, phosphates soluble in a 2 per cent. citric acid solution), and to be sufficiently finely ground that at least 80 per cent. will pass through a 'standard' sieve (10,000 meshes to the square inch).**

"The highest grades of Basic Slag range from 38 to 42 per cent., medium grades from 30 to 35 per cent, and low grades from 21 to 26 per cent of Total phosphates

"Generally speaking, at least 80 per cent. of the Total phosphates in a Basic Slag are soluble in the citric acid solution above mentioned. Accordingly, a high grade Basic Slag would contain from 30 to 34 per cent, a medium grade from 24 to 28 per cent, and a low grade from 17 to 21 per cent of 'Citric soluble' phosphates."

A bad case of adulteration of basic slag was brought to my notice. A member purchasing "Basic Slag" at 60s. a ton in June, 1917, and guaranteed to contain 18 per cent. "soluble phosphate," had 24 tons supplied to him by a south of England firm. On sending me samples of two lots supplied, I found them to contain a quantity of hard white particles which further examination showed to consist of refuse from pottery manufacture. Doubtless, they were from the bone-ash used in the manufacture, and, as such, would contain a certain amount of phosphate, but in a hard, insoluble form, which would not break up readily in the soil. The analyses were :—

	Lot 1 Per cent	Lot 2 Per cent
Total phosphoric acid .	9·37	10·79
equal to tribasic phosphate of lime	20·47	23·58
Phosphoric acid soluble in 2 per cent citric acid solution	6·53	5·57
equal to tribasic phosphate of lime	14·27	12·17
Fineness of grinding	59	52

Thus, both lots were not only deficient in phosphates, but were very coarse indeed. The vendors, on complaint being made, stated that the white material was "bone phosphate," and so would be equally valuable, but such a contention, in view of the fused and insoluble, as well as coarse, condition of the material, is absurd The purchaser was advised to send the deliveries back

3. *Basic Phosphate.*

Sold under this name, by a West of England firm, I came across a material which was practically nothing more than ground mineral phosphate. Though quite good of its class, it is, as I pointed out, misleading to describe such a material by a name which must lead the purchaser to think that he is buying basic slag or something similar to it It is but right to say that the responsibility did not rest with the actual producers, but purely with the distributing firm.

4. *Compound Manures.*

As usual, a number of these have been submitted to me, some good, some bad, many very bad and sold at extravagant prices.

	A Blood Manure	B Grass Manure	C Sewage Manure
Moisture . . .	24·81	4·14	29·64
[1]Organic matter . . .	21·37	25·51	9·73
[2]Phosphoric acid .	·51	2·48	·98
Lime	25·76	16·35	26·70
Oxide of iron, &c. . .		20·58	22·20
Insoluble siliceous matter .	27·55	30·94	10·75
	100·00	100·00	100·00
[1]Containing nitrogen . .	1·21	1·10	·22
equal to ammonia . .	1·47	1·33	·26
[2]equal to phosphate of lime	1·11	5·42	2·14
Potash . . .	—	52	—

"A" cost 5*l.* 10*s.* per ton, and was sold in Notts., without any guarantee, by a local horse-slaughterer. The price was very excessive, and, ultimately, 2*l.* 10*s.* a ton was deducted.

"B" was largely composed of sewage sludge. It cost 5*l.* per ton, and would have been dear at 2*l.*

"C" cost 2*l.* 12*s.* a ton delivered, and was, likewise, much too dear.

5. *Soot.*

The variable quality of soot has often been referred to in my reports, and is confirmed by further experience of samples sent me in 1917.

	A	B	C	D
Moisture	10·53	4·26	7·94	20·76
[1]Organic matter and salts of ammonia . . .	27·87	63·61	44·69	15·45
Oxide of iron, &c. . .	41·90	8·83	16·42	21·71
Insoluble siliceous matter .	19·70	23·30	30·95	42·08
	100·00	100·00	100·00	100·00
[1]Containing nitrogen . .	·39	4·00	3·53	·15
equal to ammonia . .	·47	4·86	4·29	·18

"A" was very inferior. It cost 2*l.* per ton, and was not worth 10*s.*; it probably came from factory chimneys.

"B" and "C" were both good, especially "B"; they alike cost 3*l.* per ton at Great Yarmouth.

"D" is like "A," and was from a factory chimney, and not household soot. It cost 1*l.* 17*s.* a ton, and was not worth the carting.

The good quality of soot may, in measure, be judged by its "lightness;" a bushel of good soot should weigh about 28 lb.

6. *Miscellaneous Nitrogenous Materials.*

(*a*) Feathers.
(*b*) Silk cocoon dust.

	Feathers	Silk Cocoon Dust
Moisture	11·21	8·25
[1]Organic matter	84·87	79·98
Oxide of iron, &c.	2·28	6·73
Sand	1·64	5·04
	100·00	100·00
[1]Containing nitrogen	12·30	8·27
equal to ammonia	14·93	10·04

The feathers cost 8*l*. 5*s*. per ton delivered (in Kent), the silk dust 12*s*. 3*d*. per unit of ammonia in February, 1917 (also in Kent). Both may be considered worth getting.

7. *Potash Materials.*

As was to be expected, there were many inquiries about new sources of potash supply. Most of the samples have been of the flue dust from iron works. They contain variable quantities of potash, giving from five to ten per cent. of potash, reckoned as sulphate of potash, and the prices range from 1*l*. to 1*l*. 10*s*. per ton at works. Some samples have come from other sources and are products of different manufactures, *e.g.*, the cyanide process, the refining of sugar, cement manufacture, &c. They show great variety of composition, but many of them have the objection that the potash is not wholly, or even mainly, contained as sulphate of potash, as is the case with the natural salts, but also as carbonates and chlorides, while lime also is frequently present, and the materials have an alkaline reaction, so that it does not do to mix sulphate of ammonia directly with them, or loss of ammonia may ensue. Occasionally, too, they may contain substances injurious to plant life, such as sulphocyanides. The following are instances of these products :—

	A	B	C	D	E	F
	From cyanide process	From sugar refining	Flue dust			
Potash[1]	8·19	13·17	1·43	1·14	7·06	16·71
Lime	34·28	—	5·05	6·23	—	7·63
Magnesia	·16	—	—	—	—	—
Oxide of iron and alumina	2·34	—	36·46	37·04	30·53	36·84
Carbonic acid						
Sulphuric acid						
Chlorine						
Silica	2·44	—	25·33	29·50	19·95	17·42
Water, &c.	24·55	—	19·84	11·93	22·40	3·39
	100·00					
[1] **Equal to sulphate of potash**	15·16	24·36	—	—	—	—

"C," "D," "E," and "F," were called "potash materials." "C," "D," and "E," are probably flue dust, "E" costing 1*l.* 16*s.* a ton, and being well worth getting.

"F" was a different material, and cost 10*l.* a ton. the unit of potash being thus about 12*s.*

A sample of felspar sent me for determination of potash gave :—

	Per cent.
[1]Matters soluble in hydrochloric acid	·99
Matters insoluble in hydrochloric acid	99·01
	100·00
[1]Containing potash	·048

8. *Seaweed Ash.*

A detailed analysis of this may be interesting :—

	Per cent
Water	10·38
Oxide of iron and alumina	·95
Lime	5·89
Magnesia	3·10
Potash	5·08
Soda	11·86
Phosphoric acid	·60
Sulphuric acid	5·15
Chlorine	11·21
Carbonic acid	3·54
Insoluble siliceous matter	41·51
Organic matter, &c	·73
	100·00

This came from Guernsey, where it is regularly collected by the fishermen along the coast, is burnt by them, and sold to the farmers. Its approximate value would be from 4*l.* 10*s.* to 5*l.* a ton.

C. MISCELLANEOUS.

1. *Sugar-beet.*

The samples, of which the following are the analyses, were grown in Yorkshire.

	A	B
Water	79·50	76·17
Sugar	14·30	16·06
Crude fibre	4·02	4·95
Albuminoids, &c.	1·07	2·01
Mineral matter	1·11	·81
	100·00	100·00
Specific gravity of juice	1·078	1·085

"B" comprised the smaller and better-shaped roots, and these were the richer in sugar.

2. *Milk from Holstein Cows.*

The samples came from a herd in Sussex.

	Evening	Evening	Morning
Water . . .	86·80	86·75	86·95
Fat . . .	4·10	4·45	4·10
Solids-not-fat .	9·10	8·80	8·95
	100·00	100·00	100·00

The following is the list of samples submitted to me by Members during the twelve months December 1, 1916, to November 30, 1917:—

Linseed cakes and meals . . .	11
Undecorticated cotton cakes	7
Decorticated cotton cakes	6
Compound feeding cakes and meals . . .	18
Palm-nut cakes	1
Coco-nut cake	1
Ground-nut cakes	3
Soya bean cakes	1
Sesame cake	1
Maize meals	1
Rice meals	1
Dried grains	7
Cereals, offals, &c.	17
Sugar-beets	2
Superphosphates	7
Dissolved bones	2
Compound manures	18
Raw and steamed bones . . .	3
Peruvian guano	4
Fish meal	3
Basic slag	21
Ground phosphates	1
Nitrate of soda	1
Sulphate of ammonia	15
Potash materials	6
Shoddy	21
Refuse manures	5
Soot	7
Lime, chalk, &c.	12
Waters	37
Milk and butter	27
Soils	36
Miscellaneous	8
Total	311

J. AUGUSTUS VOELCKER.

1 Tudor Street, E.C.
December, 1917.

ANNUAL REPORT FOR 1917 OF THE BOTANIST.

SEED-TESTING.

DURING the course of the year 108 complete analyses of seed samples were made. Germination tests only were made also on 76 samples of cereals. The majority of the cereal seeds were received soon after the harvest of 1917. They were, for the most part, somewhat weathered and, compared with the seeds of the 1916 crop received earlier in the year, markedly deficient in germinating capacity. Apart from these the seeds, as a whole, were satisfactory, though the germinating capacity did not, on the average, quite reach the standard of previous years. The farm grasses were again represented almost exclusively by perennial and Italian rye-grass, and for the first time for some years not a single grass seed mixture was sent in for analysis. No analyses of mangolds were required for some inexplicable reason.

During November, 1917, an order was issued from the Board of Agriculture and Fisheries making it compulsory for dealers in agricultural seeds to provide purchasers with a declaration stating the purity and the germinating capacity of most of the seeds in general use. Further, this declaration has to contain precise information as to the actual variety sold in the case of the cereals, clovers and sainfoin. Consequently, in the event of disputes, the dealer can no longer shelter himself behind the statement so often placed in seed bags that he "gives no warranty express or implied as to description, quality or any other matter of any seeds he sends out, and that if the purchaser does not accept the goods on these terms they are at once to be returned."

To ensure the even working of the order a Government seed-testing station has been established in the Food Production Department, 72 Victoria Street, London, S.W.1, at which farmers and seedsmen can have their seeds tested, the former at a nominal fee of 3*d.* per sample.

As the method to be adopted for testing grass seeds is one which will be unfamiliar to those accustomed to the methods used in the Society's Botanical Department and in practically all other seed-testing stations, a somewhat detailed explanation of it becomes necessary.[1] Incidentally this will raise questions as to the value of the method.

In making an analysis of grass seeds it has hitherto been the almost invariable custom to separate out all pieces of grit, fragments of stems, chaff, &c., and determine the percentage of these impurities by weight. The purchaser then knew precisely what proportion of his purchase consisted of the seeds he required. The germinating capacity of the pure seed remaining after this separation was then ascertained, and the figures provided an accurate idea of what proportion of the seed was capable of growth and what proportion was useless owing to such causes as bad storage, bad harvesting, old age, and so on.

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[1] The adoption of this method is due to a compromise. For details see *Journ. Board of Agriculture*, January 1918.

One of the definitions of the new order, however, makes it clear that this method is to be supplanted by one used for nearly twenty years by the Irish Department of Agriculture and recently adopted by the Scotch Board of Agriculture, though in spite of strenuous propagandist efforts it is not recognised by any of the important seed-testing stations. The method in general use, known sometimes as the Continental, sometimes as the Universal system, classed any empty paleae which had not been completely removed during the cleaning processes to which grass seed is subjected as an impurity under the name of "chaff." According to the Irish method single paleae count as chaff, but if the two of them are united they count as a seed even though no grain is present between them. In making a germination test therefore these empty paleae are included as real seeds, though they are structures which it is recognised cannot give rise to a seedling under any conditions whatever. The results of this convention will become obvious from the consideration of a few examples. In the first case, suppose that a sample consists of perennial rye-grass only and that it contains chaff in such a proportion that for every sound seed there is one pair of empty paleae, *i.e.*, one "seed" present. The analysis from the Government seed-testing station would reveal the fact that the sample has a purity of 100 per cent. and, assuming that all the real seeds are capable of growth, a germinating capacity of 50 per cent. The system hitherto used in the Botanical Department would state the result as :—Purity 87 per cent. (as the chaff weighs some 13 per cent. of the total weight of the sample), and germinating capacity 100 per cent.

The two sets of figures obviously bear no relation to one another, and it is clear that one or the other of them fails to express the results in a manner which can have any practical value. One need only ask whether the purchaser of a hundredweight of this seed receives 56 lb. of rubbish with it or only some 14 lb. (*i.e.*, roughly 13 per cent.) to decide which expresses the facts most correctly.

The question focusses the attention on the fact that seeds are purchased by weight, and that an analysis to be of any use must express the results on the basis of weight, and not numerically. The objection may be raised that in the Continental system the percentage of germination is determined numerically, but in this case the figures obtained do form an index of the percentage weight capable of germinating, since live and dead seeds have much the same average weight. If, for instance, 80 per cent. of the seeds in a pure sample grow, it will rarely be wide of the mark to consider that 80 per cent. of its weight is good seed.

As all calculations on the comparative value of samples, or, again, as to the quantities of seed to be sown either alone or in mixture, depend on weight, the adoption of this method of analysis is unfortunate.

The following examples will serve to illustrate these points. If a pure sample of rye-grass with a germinating capacity of 100 per cent. is worth sixpence per pound, a sample showing by the Irish method a purity of 100 per cent. and a germinating capacity of only 50 per cent. (owing to the presence of chaff in the proportions quoted in the first example) is certainly worth more than half this sum. Its proper value to the purchaser is obviously sixpence per pound less one-eighth, *i.e.*, the weight of the useless chaff.

Again assume that a seeds mixture has to be made up on the basis that it must provide amongst other things two million seeds of rye-grass per acre. As there are roughly 250,000 seeds in a pound, eight pounds of pure seed would give the required result. But if the only source of seed available was that of the first example, the Irish method of analysis would fail to indicate that an approximately correct result could be obtained by adding another pound of seed, while a very fair degree of accuracy could be obtained by adding an additional two ounces to compensate for the chaff in the make-weight.

Another defect introduced by the convention that empty paleae are really seeds is that the resultant analytical results mask the information given by the Continental system as to the proportion of dead seeds. The information is important inasmuch as it is an index of such features as the age of the seed, admixture of seed of various growths, bad storage, bad harvest conditions, &c.

A comparison of analyses made by both systems on a sample similar to that already considered, except for the fact that one-fifth of the real seeds are dead, will illustrate this point. The Irish method will state the result as purity 100 per cent., germinating capacity 40 per cent.; the Continental, purity 87 per cent., germinating capacity 80 per cent. The latter shows clearly that for some reason or other 20 per cent. of the seeds fail to grow, but the former draws no distinction between its conventional "seeds" and dead real seeds.

Other defects will probably become obvious to those accustomed to make an intelligent use of analytical results. The one excuse the protagonists of this novel method have to offer is that it secures great accuracy. There can be no doubt that a really utilitarian mode of analysis is worth more than an analytical method of no practical use even if it should be slightly less accurate.

That the accuracy obtained by the use of the Continental system is sufficient for practical purposes seems to be proved by its almost universal use. Moreover, the Irish method with moderately bad samples of seeds, with those, that is, that require the most careful analysis, by arbitrarily depressing the values of the germinating capacity carries the figures into regions where the margin of error becomes greatest. For instance, if the germinating capacity is between 95 and 100 per cent, the "latitude" allowable on a somewhat generous scale is 4 per cent., but with figures of 50—55 per cent. the latitude becomes 10 per cent. Questions of compensation then become excessively difficult.

WHEAT.

The numerous inquiries (seventy-eight) concerning the wheat crop were closely connected with its varying prospects at different periods of the year. It will serve a useful purpose to recall these. Owing partly to weather conditions and partly to deficiencies in the labour supply, autumn planting was carried on with considerable difficulty in many parts of the country. Exceptional wintry conditions, lasting from December until March, then followed with the result that it was impossible to plant up the large area which every one was beginning to recognise was necessary. The young crops, too, were severely damaged by the long spell of bad weather, and the whole outlook in the early spring was most unpromising. In many districts the surviving plant was so scanty that in normal times it would have been ploughed up and oats or barley taken in its place. Even moderately good plants seemed to be exceptional. Many of the worst of these were saved by patching either with barley or spring wheats; the rest made a remarkable recovery in the late spring and early summer. They grew rapidly and remained so singularly free from disease that by June there was every prospect of an average crop. Unfortunately, as the grain reached the last stages of ripening, a spell of excessively wet weather set in in most parts of the country. In the earliest districts harvesting had started before the wet weather began, and the wheats in stook suffered badly. More generally, though, in the districts south of the Humber the excessive wet caused the grain to sprout whilst the crops were still standing.

As was only to be expected from the conditions obtaining during the early spring, the area under spring wheats was considerably increased, the increase amounting to 50 per cent. No figures of the yields per acre have been received yet, but most of the crops seen about harvest time appeared to be yielding as well as those from autumn sowings.

At the beginning of the wheat year inquiries centred round the question of the best varieties for producing the heaviest possible crops. Then, as the winter wore on, and it became clear that a large area would have to be sown with spring wheats, the question of suitable varieties again became general. The likelihood of this had been foreseen and provided for, as far as possible, by the issue of a leaflet on the subject. The question of patching, too, led to several inquiries. Later in the year attention was called to several cases of wheats—sown as spring wheats—failing to come into ear at the normal period. In each case, further investigation showed that the variety used was one unsuited for spring cultivation. The fact cannot be over-emphasised that relatively few of the kinds of wheat which can be obtained in this country can be sown with safety after the end of February, and that a choice must be made of the varieties mentioned in the leaflet on spring wheats, or in an article on the same subject in this Journal (Vol. 76, 1915, page 37), if success with the crop is to be a certainty.

After harvest the one subject on which information was required was the rate per acre for sowing weather-damaged seed corn. When grain is cheap and plentiful a considerable deficiency in the germinating capacity can be compensated for by the simple expedient of proportionally increasing the seed rate. Under the present conditions though, when grain is scarce, and good seed corn can be obtained at very little advance in price over the ordinary, it is economical as well as to the national interest to purchase sound stocks of grain if the home grown supply fails to germinate over 80 per cent.

The barley and oat crops together only accounted for thirty inquiries. The former crop was in most districts distinctly good, but the oat crop, when returns are available, will be found to be under average. The dry weather during June was the direct cause of most of the inquiries. Where the crops had not become thoroughly established, and especially on the lighter classes of soils, they suffered to such an extent that there was no chance of their ever producing an average yield. Under the impression that these partial failures were due to plant pests, specimens, chiefly of barley, were sent to the Botanical Department throughout the month of July. In most of these the lowest leaves had either turned yellow or died completely, whilst the plants were only some six inches high. At this date anything more than a partial recovery could not be looked for, even under the most favourable circumstances. The best course to adopt appeared to be to abandon the crop and replace it by some rapidly growing crop, such as turnips or mustard. In one case, where the crop was retained, the straw, in the best part of the field, was under a foot in height at harvest time, and the yield was estimated to amount to fourteen bushels of indifferent grain per acre.

Many oat crops were badly damaged by wet during the harvest, and it is probable that the available seed supply will have a lower germinating capacity than usual. There appears to be, as in the case of wheat, a considerable difference in the extent to which different varieties are damaged by the same weather conditions. In one case reported to me fields of Excelsior and Abundance were cut on the same day, and unavoidably left exposed to a fortnight's wet weather. The former was finally carted in almost perfect condition whilst almost every grain of the latter had sprouted.

POTATOES

The efforts made to increase the area under potatoes and to minimise the losses caused by disease resulted in more attention being paid to this crop than usual. *Phytophthora infestans*, the fungus responsible for potato disease, was so late in appearing that up till the end of the first week in August one had hopes that, for once, it would fail to attack the crop. Once it had put in an appearance, however, it spread with its usual rapidity, but it is doubtful whether the damage caused was as extensive as usual, owing to the fact that the crop had already reached the last stages of development. Several of the minor diseases to which potatoes are liable were received from time to time from the beginning of June until the crops were lifted

The official recommendation of Burgundy mixture as a preventive of disease, rather than the more generally used Bordeaux mixture, led to a certain amount of correspondence. It remains to be seen whether there is any marked difference in the efficiency of the two mixtures. If there is not, Bordeaux mixture, which is comparatively troublesome to prepare, will be replaced by Burgundy mixture in the future.

It is becoming clear, though, that excellent as the results of spraying are, the one solution of the potato disease problem is to be found in the introduction of disease-resisting varieties. This season, great breadths of potatoes in the fens were left unsprayed, partly because the weather conditions, which were ideal for the spread of the disease, rendered spraying impossible, and partly because the vigorous growth of the haulm made it impracticable to get horse or power-driven sprayers between the rows.

ROOTS.

Mangolds, which, as a rule, are a healthy crop, proved to be better and healthier than usual. In fact, only two inquiries were made regarding them throughout the season. Swedes, on the other hand, were not so satisfactory, and partial or complete failures were not uncommon. A common experience seems to have been that the earliest sowings gave excellent crops, whilst those made at the usual time, or a little later, were first attacked by fly, and then crippled by drought before they were thoroughly established.

WEEDS.

Inquiries regarding weeds were about as numerous as in former years (thirty-seven). No fatal cases of stock poisoning were reported, but specimens of three poisonous weeds, viz., hemlock, œnanthe, and meadow saffron, were sent in for identification. The œnanthe was responsible for symptoms of poisoning in stock. These were grazing during March in fields on which ditch cleanings containing its tuberous roots had been spread.

If the frequency with which they are sent for identification is any reliable guide spurrey still gives more trouble than any other weed of arable land, whilst the dyer's greenweed occupies the same position with regard to grass-land weeds.

The impossibility of keeping the land clean with an inadequate supply of labour will bring the subject of weed extermination into great prominence. There can be no question that weeds are best controlled by continuous cultivation. But this is steadily becoming impossible, and other methods will have to be devised to take its place. The great desideratum is a method capable of rapid application over large areas of land. Spraying, employed so successfully in the case of charlock extermination, appears to be the method offering most possibilities in this direction, and it is to be hoped that an opportunity will be found in the coming season to investigate the matter more fully than has been possible this year.

GRASSES AND CLOVERS.

Botanical problems arising from the management of grass land and clover leys were fewer than usual. Four simple mixtures for short grass leys were suggested to correspondents, and four inquiries answered with regard to improving yields of hay. Amongst the five inquiries dealing with clovers the only one of interest was concerned with the difficulty of establishing a plant of lucerne on a light soil which hitherto had not been down to this crop. It seemed probable that the addition to the seed before sowing of a few pounds of soil from a field on which the crop was growing would meet the difficulty.

PLANT DISEASES.

From a numerical standpoint plant diseases appeared to be as important during 1917 as in former years. Forty-six inquiries in all were received on this subject, whereas one expects, from former experience, to receive from 40 to 50. But the diseases due to fungoid pests have not been nearly so serious as usual, and the amount of damage caused, compared with that of the previous year, appears to be slight. The majority of diseases reported on were those of garden rather than of farm crops. Some of the inquiries owed their origin to the interest members were taking in the efforts made by allotment holders to grow a portion of their own food supplies. Amongst these relatively unimportant diseases were mildews on onions and parsnips, white rust on salsify, black leg on potatoes, and a black spot disease (*Septoria apii*) on celery. This Septoria has already done an unusual amount of damage and the attack still seems to be spreading Scab, both on apples and pears, has been rather prevalent and perhaps more than usually destructive. The only unusual disease amongst farm crops was a case where winter beans, already damaged by the wintry conditions, were further crippled by an attack of a species of Sclerotinia The Sclerotia were found in some abundance on the upper part of the root system, but an attempt to germinate them with the object of identifying the species failed. The Sclerotinia responsible for clover sickness can be made to attack beans, and it is possible, but unproved, that the disease was due to it in this case.

GENERAL INQUIRIES.

These are often of some interest, but too diverse to summarise adequately in a brief report The utilisation of fungi as foodstuffs formed the subject of three inquiries, and several specimens were sent with the request for information as to whether they were edible or not. It is well known that a very considerable number of common species can be eaten without producing ill effects, but relatively few are worth the trouble of collecting and preparing. Further, the risk of confusing edible and poisonous species is so great that, generally speaking, no species should be eaten until it has been pronounced harmless by some one thoroughly familiar with our large fungus flora. For the same reason it is unwise to attempt to identify them from technical descriptions or coloured illustrations, except in the case of unmistakable forms, such as giant puff-balls, chantarelles, and morels.

Information as to the possibility of cultivating two exotic plants, kudzo and gram, as farm crops, was asked for. Nothing is apparently known with regard to the possibilities of growing the former in this country, and the impossibility of obtaining plants or seeds made experiments on the subject out of the question. The latter is known to be useless under our conditions.

The contents of the crop of a pheasant sent for analysis to the Botanical Department are perhaps worth calling attention to, in view of the renewed interest taken in the food supply of these birds They consisted almost entirely of the tuberous roots of the lesser celandine, together with fragments of roots apparently belonging to docks, though not identified with certainty.

R. H. BIFFEN.

Cambridge,
November, 1917

ANNUAL REPORT FOR 1917 OF THE ZOOLOGIST.

INTRODUCTION.

TWO causes have combined to make the past season the busiest ever experienced by the Zoological Department—the exceptional severity of the attacks of many common insect pests, and the great increase in the numbers of allotment holders and food producers on a small scale.

In addition to the routine work of answering applications for advice in individual cases, the Society's leaflet on Warble-fly has been re-written, and has given rise to a considerable amount of correspondence. A special investigation was also made into the beetles injuring plum trees in the Evesham district, and the leaflet written upon them and distributed by the Society to the fruit-growers interested is, for the sake of permanence, included in the present Report

FOREST TREE PESTS.

In this section few complaints have been received, foresters having been generally too much occupied with war work to pay much attention to insect pests. Larch-bug, beech coccus, pine-shoot tortrix, and a few other common forest insects have been notified from time to time, but the only case which calls for special mention, on account of its rarity, is an attack on holly trees in Derbyshire by the caterpillars of a small moth, *Grapholita naevana.* Exceptionally fine holly trees were said to have been much disfigured, and even threatened with destruction, for some years past. Specimens of injured shoots received in June quite bore out the serious nature of the injury. The leaves of the terminal shoots were drawn together, and the caterpillars were feeding upon them and upon the bud within, so that all new growth was greatly interfered with. Both caterpillars and chrysalids were found in the material sent, and very soon, at the end of June, specimens of the moth were obtained and identified.

The usual books on Forest Tree Pests are quite silent about this insect. Gillanders (*Forest Entomology*, p. 266) describes precisely similar injury which he attributes to an altogether different moth—*Paedisca ophthalmicana*—which is normally a willow pest, and which appears to me very unlikely to be found attacking hollies. On the other hand, the moths are so different that they cannot very well be confounded. In any case the present insect was *Grapholita naevana*, a moth which is known to attack hollies, though seldom to so serious an extent.

Very soon after my receipt of the specimens, moths began to emerge, and I recommended that the trees should be immediately severely pruned, and the prunings burnt, together with all fallen leaves and rubbish beneath them, so as to prevent the emergence of any more moths to lay their eggs on the new shoots. A persistence of such treatment for two or three years would almost certainly get rid of the pest, but it would be advisable to operate somewhat earlier, in the middle of June, before any of the new brood hatched out.

FARM AND GARDEN PESTS.

Though many insect attacks in this section have been unusually severe, and more applications for advice have been received than in any previous year, there is yet little that calls for special comment.

Cereals.—As was expected, a good deal of frit-fly appeared in the oats which, on account of weather conditions, were obliged to be sown late. This was foreseen in "Occasional Notes No. 1." One correspondent reports very beneficial effects of a dressing of nitrate of soda at an early stage of the attack.

Wire-worm did much damage in some districts. The exceptionally good tilth obtained after the frosts of the severe winter seem to have been favourable to this pest. One case was particularly instructive, and deserves noting. A field of oats was severely attacked, and practically ruined, the only good patches being on parts where the soil had been so consolidated by the pressure of stacks and traction engines that at the time of ploughing it was hardly expected that any plant at all would be obtained on them. On such spots only did the oats come up well, the wire-worm being unable to work. Barley was drilled where the oats had failed, and succeeded very well, its more rapid germination in favourable weather enabling a good proportion of the seeds to come up notwithstanding the pest.

There was a good deal of wheat bulb-fly, but the cases of gout-fly in barley were not numerous. One bad instance of corn-thrips occurred, and late in the summer attacks of corn aphis were numerous. Fortunately the grain was then hardening, so that little harm was done, this pest being only greatly destructive when the grain is soft.

Roots.—There were a few complaints of turnip-fly and of mangold-fly, and one case of the pygmy beetle in mangolds was reported, but the most troublesome root pests were undoubtedly surface caterpillars, which seemed to abound everywhere and to do a great deal of harm.

Peas and Beans.—Almost all the pests incidental to peas—thrips, midge, moth and aphis—occurred in various districts, but here again one insect stood out as injurious to an unprecedented extent, the *Sitones* weevil. This insect is always present to some extent in gardens and allotments, and no field of peas or beans fails to show traces of its work in the form of a characteristic "scalloping" of its leaves, but I have never before seen it so destructive of young garden peas, the foliage of which was practically devoured by the weevil in many cases where prompt action was not taken. The most effective measure was a heavy dressing of soot on the plants attacked.

Cabbage, Cauliflower, &c.—There was a perfect plague of cabbage moth and the large and small white butterfly during the past season. As usual, field crops suffered comparatively little, but the utmost vigilance failed to keep the plants in gardens and allotments reasonably free from caterpillars. A correspondent who sprayed some plants with "abol," and dusted others with hellebore, reported no success whatever. Even very special attention on a small scale, including the destruction of thousands of eggs on the leaves and the payment of boys in the village for the bodies of hundreds of the butterflies, had little perceptible effect. Hand-picking the caterpillars is feasible and useful in the case of young plants, but when the cabbages develop a heart, one is quite baffled. No doubt the multitude of white butterflies last summer was quite unusually great, but it must be confessed that no satisfactory means has been devised for dealing with a pest which is annually a great nuisance in the garden.

Celery.—Another common pest very troublesome in gardens and allotments was the celery-fly, *Acidia heraclei.* Its "blisters" were to be found on the leaves of celery, parsnips, and also parsley. This is an attack which, on the small scale, well repays a little trouble. If, soon after the plants are planted out, the rows are carefully gone over and any developing blisters pinched or the leaves containing them removed and burnt, little further attention will be necessary for some weeks. In September, however, a recurrence of the disease will probably be noticed—due to flies from neighbouring gardens—and the plants will have to be watched, or the attack will make headway rapidly.

The examination of a large number of the maggots of this fly still in the leaves at the end of October revealed the fact that nearly every maggot was parasitised and contained within it one or more chalcid grubs I am unable to say whether this is usually so or whether it is an exceptional circumstance which indicates that celery-fly is likely to be less troublesome for a year or two.

FRUIT PESTS.

Complaints have been received of most of the insects ordinarily injurious to fruit, including gooseberry saw-fly, pear-midge, codlin moth, raspberry beetle, pear blister-mite, and a great variety of caterpillars. Two fruit pests of growing importance have received much attention at Cambridge during the past summer—capsid bugs on apple, and the strawberry moth. Messrs. Petherbridge and Husain have made a thorough study of capsid bugs, which in certain districts have of late years done more harm in orchards than any of the better known injurious insects, and the results of their investigations will soon be published. It appears that though several species of capsid are to be found on apple trees the injury to the fruit is always attributable to one species—*Plesiocoris rugicollis*—and that two sprayings of nicotine and soft soap delivered in a peculiar manner and at the proper dates result in a much increased yield of clean fruit.

Strawberry moth, to which attention was called in the Zoologist's Report for last year as a pest very seldom complained of, recurred this season to an injurious extent in the same districts. Mr. Petherbridge succeeded in finding the eggs, which resemble those of the codlin moth, and are laid on the stipules. It is proposed to try the effect of arsenic sprays next summer.

It will be well to include here my special report, published by the Society and distributed in leaflet form, on

SHOT BORER BEETLES IN PLUM TREES.

In July last I received a letter from a fruit-grower at Evesham saying that he was losing trees from what he suspected to be the "shot borer" beetle, and that he believed that several other growers in the district were in the same position. The matter seemed so important that I was instructed by the Royal Agricultural Society to go down and investigate it on the spot. I arrived at Evesham on August 14 and left on August 16. The garden which was my special objective consisted of young plum trees, excellently cared for, and most of them bearing splendidly, but here and there a tree was dying, and the cause of death was by no means obvious. Traces of an injurious bark-beetle, *Scolytus rugulosus*, were present on many of the trees, but to so slight an extent that I was convinced that the death of the trees was due to some other cause. I sought in vain for any sign of the more deadly *Xyleborus dispar* on the branches, which it is usually said to prefer, and it was not till I had a dying tree cut down and had entirely overhauled it at a carpenter's bench that I came across the workings of this beetle low down on the trunk.

Two injurious boring beetles were thus proved to be present in the fruit garden. It would require a long sojourn in the district to determine how widely spread the attacks are, but conversation with other fruit-growers gave the impression that many were suffering in the same way, and I think it highly probable that if I had been invited to visit a garden less well tended in all respects I should not have had much difficulty in finding traces of *Xyleborus dispar*, the most rapidly fatal of the boring beetles in fruit trees.

A few notes on boring beetles, and especially on the two species above named, will, I think, be of interest to fruit-growers.

The name "shot-borer" or "shot-hole borer" is unfortunately applicable to a large number of beetles, and it is a very difficult matter for anyone but an expert to distinguish between them. It is alarming for a grower who is losing trees to observe his fences riddled with "shot-holes." It may be said at once that though fresh un-barked orchard props are a well known danger among fruit trees, wood which has been dead for some time, however much riddled, is harmless in this respect. The beetles which have bored it will not attack growing timber, though absolutely dead parts of old trees will quickly become perforated in all directions. These borings follow no particular plan but meander through the dead wood till it is quite disintegrated, the chief pre-occupation of the beetle being to avoid the tunnels of its neighbours. Only growing or quite freshly felled timber is capable of providing beetles injurious to healthy trees.

Of the beetles which bore into growing trees there are two categories—those whose work is confined to the bark, and those that bore deeply into the wood. *Scolytus rugulosus* is a bark beetle; *Xyleborus dispar* is a wood borer. The bark beetles make shallow entrance-holes and then tunnel a gallery where the bark meets the wood. At the sides of this gallery eggs are laid, and the grubs which hatch out make smaller tunnels at right angles to it, and finally turn to beetles at the ends of these tunnels and eat their way directly to the outside, so that for every entrance hole there will by and by be a considerable number of exit holes, and there is plenty of external evidence of the injury that is being done. The wood-borers are not all alike in their method of working, but in the case of *Xyleborus* the chief harm is done directly by the mother beetle, and the larvæ do not bore at all. There may be no external evidence of absolutely fatal injury except a single small entrance hole, often very difficult to find because of the dressings which have been applied to the trunk since it was bored.

I will now give a short account of these two beetles.

Xyleborus dispar, the "Shot-Hole Borer."—*Xyleborus dispar* is a small beetle which attacks many kinds of tree. In fruit gardens plum trees and apple trees have suffered most from its attacks, but it is very fond of oak, and has been found in beech, maple, hawthorn and several other species. The female is about one-eighth of an inch long and the male much smaller. A minute description of it is unnecessary here, as it may readily be identified by its borings.

The chief attack is certainly in the spring, but it is spread over a long interval. The female bores into the wood and makes a complicated system of galleries. One is usually horizontal and curved, following one of the annual rings of growth, and others proceed for an inch or two up and down in the wood. These borings are two millimetres (one line) in diameter, and are quite sufficient to cause the speedy death of a branch or a young stem, though the only outward sign of injury is a single small hole. In these galleries the beetle lays eggs, which begin to hatch in June. The grubs do not bore, but live upon the sap which flows into the tunnels, and perhaps upon a fungus generally to be found growing there. The larvæ complete their growth and turn to beetles in the galleries, which will be found packed with them at the end of August and the beginning of September. What follows is not easy to understand. It does not seem possible for these beetles, emerging just at the time that the flow of sap is ceasing, to rear another brood in time for the spring attack. Yet some movements certainly take place. Galleries examined in September are packed with beetles—nearly all females. Those examined in mid-winter contain fewer beetles with a much larger percentage of males. There are here obscure points that I greatly hope Evesham fruit-growers will help me to clear up by supplying me with material. Some Continental writers assert roundly that there is one brood only. Mr. Theobald has found the beetles mature during many different months of the year. The evidence seems to me to warrant the belief that there is one regular spring attack, but that it extends over so long a period that generations overlap and lead to confusion in the autumn observations.

Treatment.—I do not propose to teach fruit-growers their business. They will know far better than I can tell them what measures are practicable, and my function, as I understand it, is to place before them certain considerations and suggest the lines upon which they ought to act.

We have here a recognised forestry pest, and we must take a leaf out of the book of the foresters. Their measures against such a pest fall under three heads :—

A. The removal of all sources of infection.

B. Dressing the trees to make them obnoxious to the beetles.

C. The use of trap-trees.

Let the fruit-grower bear in mind two dates which appear to me of special importance :—June, when the first larvæ hatch out, and September, when the borings are packed full of beetles, mostly females.

A. The removal of sources of infection.—Now here, it appears to me, Evesham fruit-growers have an opportunity which may never recur. With the powers possessed by the Food Production Authorities it should be possible to compel the immediate destruction of all hopelessly infested plum trees which are only breeding beetles to attack the sound trees in their neighbourhood. And from the dates insisted upon above it is clear that it is desirable to cut them down and burn them during the first half of September, thereby destroying the maximum number of beetles. For reasons which I shall give under C., I do *not* recommend taking up the stumps till a much later date.

But infested plum trees are not the only possible sources of danger. Wood stacks should be looked to. I do not know how it is with the plum-borer, but in the case of other boring beetles wood stacks are a fertile source of infestation. Moreover, I should give an eye as far as possible to hedges and forest trees in the neighbourhood of gardens, for as we have seen *Xyleborus* attacks hawthorn and many other trees. The danger of using unbarked orchard-props has already been pointed out.

B. Dressing the trees to make them obnoxious to the beetle.—The dressing should be in the form of a stiff paste, applied with a brush. Several have been recommended for the purpose, notably (a) clay and lime ; (b) Saunder's wash (soft soap and washing soda) ; (c) soft soap with a trace of carbolic acid ; (d) clay with arsenate of lead (where no stock are grazed in the orchard). The chief point is the time of application. June dressings are of no use against this pest, as the chief injury is done before that date. The most dangerous time is during the months March, April and May, and the trees should therefore be dressed early in March.

C. The use of trap-trees.—If the beetles are not only warned off the plum-trees but are provided with acceptable timber to attack, there should be great hope of clearing them out of a fruit garden. The idea of course is to induce them to lay their eggs in the trap-trees, which are to be finally removed and burnt in June, when the eggs begin to hatch, but none have as yet turned to beetles.

Now here, I think, the stumps of felled plum-trees will be very useful. Mr. Bedenham questions the advisability of deferring their removal, but can we afford to dispense with such very appropriate traps ? I am told that the plan I advocated of driving newly-cut oak stakes into the ground among the plum-trees would present difficulties, as there is not a great deal of oak in the neighbourhood ; it seems to me, therefore, that it would be foolish not to utilise such ideal traps as the plum-tree stumps afford.

In any case I confidently recommend the plan of leaving such stumps till the end of May next, for if the infested part of the tree has been burnt they can do no harm and will certainly attract the beetle. If oak stakes can be obtained they should be used ; failing these it might be advisable to use the easily obtainable hawthorn stakes. The necessary conditions are that they should be freshly cut, driven into the ground so as to keep them alive for some time, and removed and burnt by June.

Bark Beetles.—I may deal more briefly with the bark beetles because it is very much more easy to recognise their presence. Though not so rapidly fatal as *Xyleborus* the injury they ultimately do is hardly less serious. From specimens I have received since my visit to Evesham it would appear that in some fruit gardens they are the chief cause of the failure of the trees. Their mode of procedure has already been described. The galleries made by the mother beetles are not in themselves very serious, but the grubs burrow in the bark, and the effect is cumulative, large areas of bark being undermined and practically destroyed if the attack is unchecked.

The bark beetle I found at work was *Scolytus rugulosus.* called sometimes the "Fruit Bark Beetle." This is an even smaller insect than *Xyleborus*, generally about $\frac{1}{10}$ inch in length and the holes it makes in the bark are no bigger than pin pricks. A few such holes scattered about some inches apart signify that the beetles have entered to lay their eggs. A multitude of tiny holes on a few square inches of bark indicate that the beetles which arose from those eggs have now emerged —for each beetle makes its own exit hole. The Spring attack begins in April or May but is at its height in June, and in August a new brood has come to maturity. It was no doubt this second brood that I saw attacking plum-trees on August 15. A third brood may appear in October, but this is probably to some extent dependent on the weather. Plum and apple are the favourite food plants. "Saw-dust" coming out from small holes on the trunk or branches is a sure sign that the mother beetle is at work.

The general methods of treatment recommended against *Xyleborus* apply here, but there are certain differences to be observed. Wood-stacks containing plum or apple branches are even more dangerous than in the case of that beetle, for *Scolytus* will breed in timber that has been felled for quite a long time, whereas *Xyleborus* requires it to be more full of sap. Again, trap-trees in this case must be stakes of fruit-trees, as the beetle does not attack oak, so that we have here a powerful argument for making all possible use of the stumps of such trees as have had to be cut down. If they are left in the ground until June many bark-beetles will lay their eggs in them, and they may then be grubbed up and burnt.

ANIMAL PARASITES.

The new Warble-fly leaflet issued in the Spring gave rise to a large amount of correspondence, many members advocating particular methods of treating warbled cattle. Mr R Stratton, of Newport, for instance, speaks very favourably of the effect of the injection of a few drops of paraffin into the warble holes, asserting that the grub is killed without pain to the animal, and is quickly absorbed.

As was expected, the point in the circular which proved most unpalatable was the statement that *preventive* smearing of cattle, when put to the rigid test of experiment, had proved ineffectual. Many members remain of the opinion, to which of course they are fully entitled, that smearing the backs of cattle during the fly season does really protect them. Surely, however, there can be no objection to my suggestion that they should test the matter themselves by deliberately leaving some of their cattle unsmeared. If these cattle become warbled while the smeared beasts are clean, naturally the treatment will be continued; but should it turn out, as in the Irish experiments, that there is nothing to choose in the matter of warbles between treated and untreated cattle, a more or less troublesome and expensive custom will probably be discontinued. The point is that unless some beasts are left as "controls," to compare with the cattle which have undergone treatment, no safe inference can possibly be drawn. The absence of warbles may simply mean that the fly does not occur in that particular district, not that the dressing has kept it off.

Army veterinary surgeons have informed me of a certain amount of trouble in horses from a warble grub which causes exactly similar swellings to those caused by the ox warble-fly, though occurring in rather different regions—notably about the withers and in places where the galling of the harness increases their painfulness. This, of course, has nothing to do with the horse-botfly, whose grub lives in the stomach, but is a true *Hypoderma*, though of a different species from those infesting cattle. Very little is known about it, and I do not believe that the fly has ever been taken in this country.

Mr. E. Wallace Hoare, F.R.C.V.S., of Cork, kindly procured me one of the grubs, but the fuller investigation of the pest at present is hardly possible, as it would of course be necessary to keep infested horses idle in order to learn anything of the life-history of the fly, instead of curing them as rapidly as possible, and returning them to work.

MISCELLANEOUS NOTES.

Notwithstanding the appearance of a large number of queen wasps in the spring, these insects were conspicuous by their absence in many districts last season, something in the peculiar weather conditions being apparently adverse to the establishment of nests. There were, however, a good many hornets in some places, and a complaint was received from a bee keeper that these insects were stealing his bees. He had observed them forcing their way into the hives notwithstanding the resistance of the scouts, and flying off with their victims, which they took back to their nests to feed to their grubs. Two hornet's nests were located in the neighbourhood, and they proved very difficult to destroy, as they were in hollow willow trees.

There have been some inquiries about Narcissus-fly (*Merodon*) whose grub destroys bulbs. Mr. E. T. England, of Exeter, tells me that he is experimenting with the view of killing the grubs while still within the bulbs, and the results of his experiments will be looked forward to with great interest.

Much interest was aroused in the summer by the reappearance of the Antler Moth (*Chaereas graminis*) in hill pastures in the Peak and the Lake District, and very alarmist reports appeared in many newspapers. The matter was at once taken up by the Food Production Department of the Board of Agriculture, and it was found that the reports had been greatly exaggerated. No good meadow grass or crops were attacked, but only upland pastures at an altitude of 750 ft. and over. The special causes to which the attack was judged to be attributable were the scarcity of birds, especially the lapwing; the severe winter with a marked absence of mild spells; and the regulations forbidding the burning of moorlands and mountain grass areas.

Cases of extraordinary increase in a common insect, owing to a combination of circumstances favourable to it, are of frequent occurrence. Such attacks, it is reassuring to note, are very rarely repeated the following year. Six previous attacks of the Antler Moth have been recorded in Great Britain during the past century. Two of these were in the same county (Cumberland), but there was an interval of seventy-five years between them.

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THE WOBURN EXPERIMENTAL STATION OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

FIELD EXPERIMENTS, 1917.

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FIELD EXPERIMENTS, 1917.

THE season of 1916–17 must be described as a very unfavourable one agriculturally. After the harvest of 1916 the months of October and November were dull, cold, and accompanied by much rain, so that preparation of the land and winter seeding were carried out with difficulty. December was better, and was followed by a mild, open time in the first part of January, 1917, the weather then turning very cold. February was exceptionally dry, only ·88 in. of rain falling, but the weather was intensely cold, with snow and frost, so that nothing could be done on the land. Then came March and April, both cold and unseasonable, though dry, causing a very late spring, with but little growth of grass. May and June were both better, and July also fair, but then followed a very wet August, rain falling continuously and putting off the corn harvest until well into September. 5·65 in. of rain fell in August. Things improved somewhat in September, and, though it was neither a dry nor a warm month, the harvest was got in. The corn yields were disappointing owing to the drought in the late spring, and the condition of the grain was much injured through "weathering," while, owing to the same causes, the hay yield was spoilt, and a great contrast to the heavy crop of 1916. Nor was the season favourable to root crops, and considerable difficulty was experienced with them in getting a plant. Potatoes also suffered very considerably from disease. The total rainfall for the twelve months was 29·25 in. as against 27·94 in. in 1915–16.

CONTINUOUS GROWING OF WHEAT (*STACKYARD FIELD*) 1917 (41ST SEASON).

The different principal operations were carried out as follows :—

1916, Oct. 6—Farmyard manure applied to plot 11b, 4 tons 10 cwt. 1 qr. 13 lb. per acre, the manure containing ·814 per cent. of nitrogen.

1916, Oct. 25—"Red Standard" wheat drilled, 10 pecks per acre; seed dressed with sulphate of copper.
„ Oct. 25—Mineral manures sown.
1917, May 11—Rape dust applied, 448 lb. per acre; contained 4·60 per cent. of nitrogen.
„ May 17—Nitrogenous top-dressings (nitrate of soda and sulphate of ammonia) applied.
„ June 6—Nitrogenous top-dressings (nitrate of soda and sulphate of ammonia), second applications.
„ Aug. 23—Wheat cut.
„ Sept. 15—Wheat carted and stacked in field.
„ Oct. 2—Corn threshed.
„ Nov. 5, 6—Corn dressed and weighed.
1918, Jan. 14—Corn valued.

The wheat came up very fairly, but did not look well in January; it improved by April, however, and in June, considering the period of drought experienced, was quite promising. Speaking generally, the nitrate of soda plots were decidedly superior to the sulphate of ammonia ones, and the farmyard manure plot seemed the best of all.

The harvest results are given in Table I., page 222.

The wheat crop was, despite the unfavourable conditions, a decidedly better one than that of 1916, and was much like that of 1915. Of the two unmanured plots, plot 7 was the more satisfactory one to take as a guide, and it showed 12½ bushels of corn per acre with practically 7 cwt. per acre of straw. Mineral manures alone gave an increase of 1½ bushels of corn and 2 cwt. of straw.

Sulphate of ammonia, without mineral manures, gave very variable results; where (plot 2b) lime had been given as long ago as 1897 there was still a crop, though a lower one than on the unmanured land, and now, for about the first time, the heavier application of lime (4 tons per acre) on plot 2bb showed superiority, giving 2½ bushels more corn per acre than the unmanured plot. The low yields on plots 2a, 5a, 8a, 8b all show that lime is required when sulphate of ammonia is used, while the similar low yields on plots 2aa, 2b, 8aa, 8bb indicate that the lime previously applied now requires renewing. On plot 5b alone, where 1 ton per acre of lime was given in 1905, is there an increase—one of 4·3 bushels of corn—over the unmanured produce.

Nitrate of soda gave markedly better results than sulphate of ammonia, the difference in its favour, on plots such as 5b and 6 which are comparable, being rather over 13 bushels. Even used by itself, without minerals, nitrate of soda at the rate of 1 cwt. per acre (plot 3b) gave 7½ bushels, and at the rate of

TABLE I.—*Continuous Growing of Wheat*, 1917 (41*st Season*).

(Wheat grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff &c
		No of bush	Weight per bushel	Weight	
			Lb	Lb	C q lb
1	Unmanured	9 5	56 0	12	5 3 6
2a	Sulphate of ammonia (=25 lb ammonia) . .	2 7	56 0	6	1 1 13
2aa	As 2a, with 5 cwt lime, Jan , 1905, repeated 1909, 1910 and 1911	11 3	55 5	20	6 2 25
2b	As 2a, with 2 tons lime, Dec , 1897	7 5	56 5	12	7 2 26
2bb	As 2b, with 2 tons lime (repeated), Jan , 1905 .	15 0	56 0	24	10 3 4
3a	Nitrate of soda (=50 lb ammonia)	23 4	52 0	60	12 3 15
3b	Nitrate of soda (=25 lb ammonia)	20 0	50 0	80	12 3 13
4	Mineral manures (superphosphate, 3 cwt , sulphate of potash, ½ cwt)	13 9	54 0	12	8 3 13
5a	Mineral manures and sulphate of ammonia (=25 lb ammonia)	11 0	56 2	10	6 2 10
5b	As 5a, with 1 ton lime, Jan., 1905 .	16 8	58 6	10	9 0 9
6	Mineral manures and nitrate of soda (=25 lb ammonia) . .	30 0	56 2	15	18 0 27
7	Unmanured	12 5	58 5	20	6 3 22
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb ammonia) .	2 0	54 0	4	1 1 27
8aa	As 8a, with 10 cwt lime, Jan , 1905	5 0	58 0	6	3 1 15
8b	Mineral manures, sulphate of ammonia (=50 lb ammonia) omitted (in alternate years)	4 6	58 0	8	3 0 2
8bb	As 8b, with 10 cwt. lime, Jan , 1905	7 5	58 0	8	5 0 8
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb ammonia)	28 5	57 5	14	16 1 23
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years) .	16 6	57 7	8	9 1 15
10a	Superphosphate 3 cwt , nitrate of soda (=25 lb. ammonia) . .	23 9	56 5	10	13 3 13
10b	Rape dust (=25 lb ammonia) .	15 6	57 5	12	9 0 5
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb ammonia) . .	26 2	57 2	14	15 2 9
11b	Farmyard manure (=100 lb ammonia)	27·9	57 2	14	18 1 18

TABLE II.—*Continuous Growing of Barley*, 1917 (41*st Season*).

(Barley grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff, &c.
		No of bush.	Weight per bush	Weight	
			Lb	Lb	C q lb.
1	Unmanured	17·2	43·7	34	11 0 1
2a	Sulphate of ammonia (=25 lb. ammonia)	—	—	4	2 0 18
2aa	As 2a, with 5 cwt. lime, Mar, 1905, repeated 1909, 1910 and 1912 .	12·6	42 0	20	8 3 3
2b	As 2a, with 2 tons lime, Dec., 1897, repeated 1912	12 6	43 0	28	11 2 9
2bb	As 2a, with 2 tons lime, Dec, 1897, repeated Mar., 1905 . .	16·9	43 2	28	11 1 9
3a	Nitrate of soda (=50 lb. ammonia)	20 8	43 1	34	12 3 19
3b	Nitrate of soda (=25 lb. ammonia)	19 1	43 2	32	11 1 22
4a	Mineral manures[1] . .	18 5	47 7	20	9 3 12
4b	As 4a, with 1 ton lime, 1915 . .	21 5	46 2	28	11 3 24
5a	Mineral manures and sulphate of ammonia (=25 lb ammonia)	4·4	49 0	4	3 1 23
5aa	As 5a, with 1 ton lime, Mar., 1905, repeated 1916 . .	27 2	49 0	32	14 0 3
5b	As 5a, with 2 tons lime, Dec., 1897, repeated 1912	21 2	47 5	28	11 1 14
6	Mineral manures and nitrate of soda (=25 lb. ammonia) . . .	24 7	48 2	32	12 3 27
7	Unmanured	14 5	47 7	20	8 0 8
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	4 7	49 0	6	3 0 7
8aa	As 8a, with 2 tons lime, Dec., 1897, repeated 1912	23·8	48 7	36	12 2 22
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years) . . .	—	—	4	1 3 1
8bb	As 8b, with 2 tons lime, Dec., 1897, repeated 1912	21·4	47 7	32	12 0 1
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia)	26·7	49 1	28	14 2 5
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years)	16·3	48·0	20	8 3 24
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia) . . .	24 5	48 7	32	13 1 18
10b	Rape dust (=25 lb. ammonia) . .	16·6	48 7	20	9 2 25
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia). . .	25·6	48 7	30	14 2 27
11b	Farmyard manure (=100 lb. ammonia)	26 7	48·7	32	13 0 13

[1] Superphosphate 3 cwt., sulphate of potash ½ cwt.

2 cwt. per acre 11 bushels, of corn increase over no manure. With minerals, 1 cwt. of nitrate of soda produced (plot 6) 30 bushels of corn with 18 cwt. of straw, this being a slightly better crop than produced by 2 cwt. (plot 9a), and plot 6 was indeed the highest yield of the whole series. Farmyard manure (plot 11b) gave only slightly lower produce and the most straw of all. It was much superior this season to rape dust (plot 10b), though previously there had been but small differences between these.

Lastly, as between 10a and 11a, the application of potash without phosphates produced 2·3 bushels more corn than did the phosphate without potash.

The grain was valued, as usual, by Mr. T. Smith, junr., of Bedford. The best samples were those from plots 5a, 5b, and 7, and the worst came from 2aa, 2b, 2bb, and 3a. Only the former were of fair average quality for the season.

The amount of tail corn was greater than usual owing to the corn sprouting through the bad weather at harvest time. The produce of plots 3a and 3b (nitrate of soda) happened to be at the top of the stack, and so experienced this the more.

CONTINUOUS GROWING OF BARLEY (*STACKYARD FIELD*) 1917 (41ST SEASON).

The principal field operations were carried out as follows :—

1917, April 9—Farmyard manure applied (plot 11b) 8 tons 5 cwt. 1 qr. 10lb. per acre ; contained nitrogen ·444 per cent.
„ April 23—"Chevalier" barley drilled, 9 pecks per acre ; mineral manures sown same day.
„ May 11—Rape dust applied (plot 10b) 448 lb. per acre ; contained nitrogen 4·60 per cent.
„ May 18—Nitrogenous top-dressings (first dressings) applied.
„ June 6—Nitrogenous top-dressings (second dressings) applied.
„ Sept. 7—Barley cut.
„ Sept. 15—Barley carted.
„ Oct. 3—Barley threshed.
„ Nov. 5 and 6—Corn dressed and weighed.
1918, Jan. 14—Corn valued.

It may be noticed that, as compared with that used earlier in the season for the wheat crop, the farmyard manure here applied was nearly twice the weight, it being so much poorer in nitrogen. This was largely due to the heap having had snow lying on it, this then melting and soaking through the mass. This matter, with the comparative analyses, is referred to in "Occasional Notes," No. 3, January, 1918. All things considered, the barley did very fairly, the crop being a better one than in 1916 or 1915, and being only slightly below that of 1914.

The harvest results are given in Table II., page 223.

The unmanured produce is best represented by plot 1, the duplicate (plot 7) having been subject to much surface washing. It amounted to just over 17 bushels of corn and 11 cwt. of straw per acre, the yield of this plot in 1914 having been 17·8 bushels of corn.

Mineral manures alone added 1½ bushels, but with the addition of lime as well (plot 4b) an increase of 4½ bushels of corn was obtained.

The superiority of nitrate of soda to sulphate of ammonia shown this year with wheat was not brought out in the case of the barley crop; indeed, nitrate of soda, used by itself, gave but small increase over the untreated plot. There was the usual failure with sulphate of ammonia used without lime (plots 2a, 5a, 8a, 8b). One ton of lime per acre (plot 2aa) proved insufficient, but 2 tons (plot 5aa) gave with sulphate of ammonia and minerals the highest yield of the whole series, viz. 27·2 bushels. The desirability of using mineral manures with lime and sulphate of ammonia was shown in the comparison of plots 5b and 2b, but doubling the amount of sulphate of ammonia did not give a paying return (compare plots 5b, 8aa).

Nitrate of soda, as stated, did not do well alone, 1 cwt. per acre (plot 3b) only giving 2 bushels more corn than the unmanured plot, and double the amount of nitrate of soda only adding another 2 bushels. Along with mineral manures, however, nitrate of soda did quite well (plots 6 and 9a), while the omission of the nitrate for a single year (plot 9b) brought the crop down to the unmanured produce.

As between phosphates and potash there was 1 bushel of corn in favour of the inclusion of potash (plots 10a, 11a).

Farmyard manure gave the second highest yield of the season, viz. 26·7 bushels of corn and the most straw (18 cwt.), this being markedly superior to the rape dust yield (plot 10b), this latter being very disappointing.

The corn was badly matured, and none of the samples were at all good, even for the season, so that detailed notes of them are not called for. The worst of all were those where nitrogenous manures had been used by themselves. On a basis of 68*s*. per quarter, the best samples were priced at 62*s*. only, the worst at 60*s*.

ROTATION EXPERIMENTS.—THE UNEXHAUSTED MANURIAL VALUE OF CORN AND CAKE (*STACKYARD FIELD*).

Series C. 1914, *Swedes, fed on by Sheep with Cake and Corn respectively*; 1915, *Barley*; 1916, *Green Crop* (*Rape*); 1917, *Wheat.*

The rape crop of 1916, which was a fair one, was fed on the land by sheep, September 6—18, the land being subsequently prepared for wheat. On October 24, 25, 1916, "Red Standard" wheat was drilled at the rate of 2 bushels per acre, and came up well. Throughout the season it did only fairly, and was not equal to the continuously-grown wheat in the same field, the straw being distinctly short. The crop was cut on August 24, 1917, and carted on September 11, the corn being threshed on December 4.

The harvest results are given in Table III.

TABLE III.—*Rotation Experiment—the Unexhausted Manurial Value of Cake and Corn. Series C* (*Stackyard Field*) 1917—*Wheat after Green Crop.*

Produce per acre.

Plot		Head corn			Tail corn	Straw, chaff, &c.	Value of corn per quarter on basis of 74*s.* 6*d.*
		Weight	Bush.	Weight per bush.	Weight		
		Lb.		Lb.	Lb.	C. q. lb.	*s.* *d.*
1	Corn-fed Plot	1,021	17·0	60·1	104	12 2 7	74 6
2	Cake-fed Plot	977	16·3	60·0	94	11 3 9	74 6

The crop, it will be seen, was poor and not 4 bushels per acre more than that given by the unmanured plot in the continuous series. Moreover, there was no apparent advantage either in corn or straw from the cake-feeding as over the corn-feeding, a result similar to that obtained on the same land with barley in 1915. The swede crop of 1914, too, had been no greater on the cake-fed plot, and, altogether, no evidence has been adduced, in this rotation, to justify in practice the generally accepted superiority of cake-feeding to corn-feeding on land of this light sandy loam character.

Series D.—Second Rotation. 1916, *Swedes, fed on by Sheep with Corn and Cake respectively*; 1917, *Barley.*

The swede crop of 1916 was, to the extent of 12 tons per acre, fed on the land by sheep with corn and cake respectively (8 cwt. per acre), the land thereafter ploughed, and Chevalier at the rate of 8 pecks per acre was drilled on April 21,

1917. The crop was a better one comparatively than the wheat one on Series C. It was cut on September 3, carted September 9—11, and threshed December 5. The results are given in Table IV.

TABLE IV.—*Rotation Experiment—the Unexhausted Manurial Value of Cake and Corn. Series D* (*Stackyard Field*), 1917. *Barley—after Swedes fed on.*

Produce per acre

Plot	Crop	Head corn			Tail corn	Straw, chaff, &c	Value of corn per quarter on basis of 68s
		Weight	Bush	Weight per bush	Weight		
		Lb.		Lb.	Lb	C q lb	s d
1	Corn-fed Plot	1,396	27 0	51 8	216	17 3 11	64 0
2	Cake-fed Plot	1,262	24·4	51 6	218	18 3 14	66 0

Here, once again, the corn-feeding has produced a crop somewhat superior to the cake-feeding as regards corn, though the straw was less. A similar result had been found on this land with the barley crop of 1913. The corn was reported as being well-grown and well-matured.

It is clear from the foregoing that, so far as regards the soil of Stackyard Field, the supposed superiority of cake-feeding to corn-feeding on the land has not been brought out. The experiments on this subject have now been conducted sufficiently long to justify this conclusion being drawn. Now and again it has happened that the barley crop immediately following the cake-feeding has proved itself better than that from corn-feeding, but this has by no means always been the case, as, *e.g.* in 1917, and previously in 1913. Further, taking into account all the four crops grown during the several rotations through which the experiments have proceeded, there has been nothing like the increase on the cake-fed land which would be represented by the difference of unexhausted manurial value between cake and corn as set out in the recognised Tables of Valuation.

This does not mean necessarily that the Tables are wrong, but it does throw great doubt on the universality of their application, and points to the desirability of extending these experiments to land of a different class to that of Woburn.

GREEN-MANURING EXPERIMENTS.

(*a*) *Stackyard Field. Series A.*

The land was ploughed and cultivated after the Wheat Crop of 1916, and green crops were drilled as follows:—

May 10, 1917, plot 1, spring tares, 2 bushels per acre ; June 2, plot 2, rape, 5 lbs. per acre, and plot 3, mustard, 1 peck per acre. The rape was much attacked by " fly," but ultimately recovered ; the other two crops did well, though, owing to the season, it was not possible to grow a second crop of either. Sheep, having also 1½ cwt. per acre of cake (half linseed cake, half cotton cake), fed off the mustard, July 17—24, then the tares, July 24—August 1, and, lastly, the rape, August 13—16, in each case with cake as above. Wheat will follow as the crop of 1918.

(*b*) *Lansome Field.*

After the green crops of 1916 the land was ploughed for wheat, and, on October 24, 1916, " Red Standard " wheat, at the rate of 2 bushels per acre, was drilled. The crop was a very poor and weak one and there was great difficulty in keeping the land clean. Accordingly only the lower plots, 2, 4 and 6 were weighed. The wheat crop was cut on August 25, 1917, and threshed on October 2, the results being given in Table V.

TABLE V —*Green-Manuring Experiment* (*Lansome Field*).

Produce of Wheat per acre, 1917—after Green Crops

Plot	Manuring in 1916	Head corn			Tail corn	Straw, chaff, &c			Value of corn per quarter on basis of 74*s* 6*d*	
		Weight	Bush	Weight per bushel	Weight					
		Lb		Lb	Lb	C	q	lb	*s*	*d*
2	Tares ploughed in, with lime	570	10 1	56 5	13	7	3	0	72	0
4	Rape ploughed in with lime	582	10 3	56 5	9	6	2	4	72	0
6	Mustard ploughed in, with lime	564	10 6	53 0	7	8	3	7	70	0

The smallness of the yields renders the experiment this season of but little value, and it is clear that some change must be introduced into the plan of cultivation.

By the constant growing of the green crops the soil has become too open, and the green crops, though they have added nitrogen to the soil, do not seem able to pass it on to the corn crop. There is, consequently, little in the results of this year on which to base any conclusion, though it is noticeable that mustard has produced decidedly the most straw with as many bushels of corn as the tares or rape.

INFLUENCE OF MAGNESIA ON WHEAT.
(*LANSOME FIELD*).

In 1915 there had been an experiment in this field, one plot of land, $\frac{1}{20}$th acre in extent, being left untreated, and an adjoining one treated with Magnesia at the rate of 4 tons per acre, the Magnesia-treated plot then yielding nearly 7 bushels more wheat and 4½ cwt. more straw per acre than the untreated. These two plots were kept under observation in 1917, and a fresh one was added to which again 4 tons of Magnesia per acre were given. Wheat ("Red Standard") was drilled on October 24, 1916, and top-dressed in May 1917 with a little sulphate of ammonia. Magnesia was applied on March 24, 1917. The crops, like the green-manuring ones in this field, were very poor, but showed a decided benefit from the application of Magnesia, whether put on in 1915 or freshly in 1917. The increase in the straw yield is specially notable. The results are given in Table VI.

TABLE VI.—*Magnesia on Wheat*, 1917 (*Lansome Field*).

		Produce per acre					
Plot	Treatment	Head corn			Tail corn	Straw, chaff, &c	Value of corn per quarter on basis of 74s 6d
		Weight	Bush	Weight per bushel	Weight		
		Lb		Lb	Lb	C. q lb	*s* *d*
1	Without magnesia	380	6 5	58 0	10	8 3 15	74 0
2	With magnesia (4 tons per acre applied 1915)	570	10 2	56 0	15	8 2 18	72 0
3	With magnesia (4 tons per acre applied 1917)	590	10 2	58 0	10	14 1 14	73 0

GRASS EXPERIMENTS.

1. *Broad Mead*, 1917.

(*a*) Improvement of Old Pasture.
(*b*) Varieties of Lime.
(*c*) Different Forms of Lime.

The demand for a large supply of hay led to Broad Mead being hayed again, for the third year in succession, and, accordingly, a further set of results is available in the above experiments. No fresh applications of lime or manure were given, but the plots were all chain-harrowed in February, 1917. The grass was cut July 2—5, and the hay carted in good condition July 4—7. The results are set out in the three Tables VII., VIII. and IX.

TABLE VII.—*Improvement of Old Pasture (Broad Mead).*

Produce of Hay per acre, 1917

Plot	Manuring per acre in 1913	Weight of hay per acre T	c	q.	lb.
1	Basic slag 10 cwt Nitrate of potash 1 cwt	1	5	1	0
2	Mineral superphosphate 5 cwt Sulphate of potash 1 cwt	1	3	2	0
3	Basic slag 10 cwt Sulphate of potash 1 cwt	1	7	3	0
4	No manure	1	4	2	0
5	Lime followed (in 1913) by— Superphosphate 3 cwt Sulphate of potash 1 cwt	1	2	0	0
6	Dung 12 tons	1	11	3	0

TABLE VIII.—*Varieties of Lime on Grass Land (Broad Mead).*

Produce of Hay per acre, 1917

Plot	Lime applied in 1910 and again in 1916[1]	Weight of hay per acre T	c	q	lb
1	Buxton lime	1	7	1	0
2	Chalk lime	1	6	3	0
3	Magnesian lime	1	7	0	0
4	No lime	1	1	3	0
5	Lias lime	1	6	0	0
6	Oolite lime	1	5	3	0

[1] Two tons per acre in each case

TABLE IX.—*Different Forms of Lime on Grass Land (Broad Mead)*

Weights of Hay per acre, in 1917

Plot	Lime applied, 1913[1]	Weight of hay per acre T	c	q	lb.
1	Lump lime	1	8	2	0
2	Ground lime	1	5	1	0
3	No lime	1	3	3	0
4	Ground limestone .	1	10	0	0
5	Ground chalk	1	11	2	0

[1] 20s per acre (independently of carriage, cartage, &c), was spent on each plot for the lime used.

The hay crop of 1917 was small as compared with the exceptionally good one of 1916, when, in several cases, over two tons per acre of hay were obtained on this field, and in one case 2 tons 8 cwt.

In the (*a*) series (Table VII.) the dung plot (6) gave, as usual, the highest return. The other results were much on the lines of 1915 and 1916, the best of these being Plot 3 (basic slag and sulphate of potash).

In the (*b*) series (Table VIII.) all the applications of lime (renewed in 1916) produced increase of crop, the greatest being with Buxton lime (plot 1), and the next best with magnesian lime (plot 3), chalk lime (plot 2) giving practically as much, and lias lime and oolite lime (plots 5 and 6) but little less. The results generally, as compared with the control plot, were more marked than in previous years.

In series (*c*) (Table IX.) again the unlimed plot (3) gave the lowest yield of hay, the highest produce being from the use of ground chalk (plot 5) and ground limestone (plot 4), both showing a marked increase on the unlimed plot.

2. CHARITY FARM—WESTBROOK FIELD, 1917.

Plot 1 (always mown) and plot 2 (alternately grazed and mown) were made into hay in 1917. The plots were chain-harrowed in May, the grass cut July 12—16, and the hay carted July 16—19. The weights of hay obtained are given in Table X.

TABLE X.—*Grass Experiment. Charity Farm, Westbrook Field.*

Plot	Produce of hay per acre, 1917	T	c.	q.	lb.
1	Always hayed	1	4	3	14
2	Alternately hayed and grazed	1	5	3	0

Samples of the hay from these plots were submitted for botanical examination to Prof. Biffen who reported that, botanically, there was but little difference between the herbage of the plots.

RAINFALL AT WOBURN EXPERIMENTAL STATION, 1916-17.
(292 ft. above sea level.)

	Total Inches	No. of days with ·01 in. or more recorded		Total Inches	No of days with ·01 in or more recorded
1916.			**March**	1·56	20
October . .	2·67	22	**April** . .	1·46	14
November . .	3·00	12	**May** .	1·96	9
December . .	2·60	14	**June** . .	2·60	9
1917.			**July** .	3·47	9
January . .	1·45	18	**August**	5·65	22
February . .	·88	10	**September** .	1·95	11
			Total . . .	29·25	170

POT-CULTURE EXPERIMENTS, 1917.

I. *The Hills' Experiments—The influence of Barium Compounds on Wheat.*

The work decided on for 1917 was to test the influence of compounds of barium, this being an element not previously studied at Woburn. The compounds selected were the commoner ones, viz., the sulphate, carbonate, hydrate, nitrate, and chloride. Of the two first-named and the nitrate, the anhydrous salts were used, the hydrate with eight molecules of water and the chloride with two. The quantities employed were, in terms of the element barium, ·10 per cent. and ·20 per cent. respectively in each case, except that with the chloride the smaller amount of ·05 per cent. was also used, since, though little was known as to the effect of barium salts, it might be expected that, if any salt proved hurtful, the chloride would. The applications were given, as usual, as percentages of the soil after fine grinding and intimate mixing of the several applications with the soil. The ·10 per cent. application, it may be said, was equivalent to a dressing of from 1¾ tons to 2¾ tons per acre, according to the different compounds used. The soil employed was that from Great Hill, and was a light sandy loam.

Each application was in duplicate the pots being prepared early in December, 1916, and wheat ("Square Head's Master") being sown December 19.

Germination was satisfactory and regular in the case of the control, sulphate, carbonate, and hydrate of barium pots, but with the nitrate ones began an irregularity extending more or less to all the nitrate and the chloride pots, this being more accentuated with the heavier dressings.

While the former applications had, by January 13, 1917, produced 9—11 plants out of 17 seeds sown, the first plants in the nitrate pots did not appear until that day with the lighter (·10 per cent.) application, and not until February 15 with the heavier (·20 per cent.). Ultimately 11 plants were obtained with the former, but 3 only with the latter.

In the case of the chloride there was retardation at first with ·05 per cent., though ultimately all 12 plants came up; with ·10 per cent. nothing came until January 21, though ultimately there were 10 plants in each pot; with ·20 per cent. in one pot 4 plants came, and in the duplicate 7, all after much retardation. All gaps were filled up by resowing, but the general results were unaffected.

From this it is clear that, in the case of barium compounds, the sulphate, carbonate, and hydrate are all without effect on germination, but that the nitrate and chloride alike act injuriously, as small a quantity as ·05 per cent. of barium in these forms retarding germination, and ·10 per cent. and more proving injurious to growth.

The above appearances were maintained pretty well all through, the control pot, sulphate, carbonate, and hydrate ones being all much alike, while the weaker plants of the nitrate and chloride series went from bad to worse. Thinning was done on April 24, the wheat came into ear June 14, and was ripe about August 10.

In the nitrate series there were, with the ·10 per cent. application, only 8 plants out of 24 possible, while with the ·20 per cent. dressing the few plants that appeared all died off entirely.

As compared with similar experiments with other salts, *e.g.* copper salts in 1914, it is somewhat remarkable that the forcing power of the nitrate did not seem to counteract the toxic effect of the element.

With barium chloride, the lowest amount (·05 per cent.), while retarding the germination at first, gave ultimately plants as good as the control ones; ·10 per cent. gave a decidedly reduced crop, and the heaviest dressing (·20 per cent.) hardly any crop at all, the injury here being very marked.

Table XI. gives the harvest results, and the relative appearances of the crops are shown well in Figs. 1 and 2.

The roots of the several sets were subsequently examined, but showed no marked differences of character.

TABLE XI.—*Barium Compounds on Wheat*, 1917.

						Corn	Straw
No treatment .						100	100
Barium	sulphate	containing	10	per cent.	barium	106 5	104 0
"	"	"	20	"	"	106 0	101 8
"	carbonate	"	·10	"	"	115 3	110·8
"	"	"	20	"	"	105·8	103·6
"	hydrate	"	10	"	"	127 0	131 9
"	"	"	20	"	"	108 4	131 1
"	nitrate	"	10	"	"	58 7	81 4
"	"	"	20	"	"	—	—
"	chloride	"	·05	"	"	115 5	104·4
"	"	"	·10	"	"	85 3	81 9
"	"	"	20	"	"	1 0	2·0

The differences in results are not sufficiently definite in the case of the sulphate, carbonate, or hydrate to draw any clear conclusions, though there would seem to be a slightly stimulating effect, more especially in the straw.

With the nitrate, however, a markedly injurious effect was shown, ·10 per cent. injuring the crop and ·20 per cent. destroying it altogether. With the chloride ·05 per cent. of barium did neither harm nor good, ·10 per cent. gave a decidedly reduced crop, and ·20 per cent. practically destroyed it.

The following general conclusions may accordingly be drawn :—

1. That barium in the form of sulphate, carbonate, or hydrate is, when used up to ·20 per cent. of barium, harmless, and, possibly, slightly stimulating in nature.

2 That barium used as nitrate is injurious at the rate of ·10 per cent. of barium, and, if used stronger, will destroy the crop altogether.

3. That barium used as chloride is harmless if not exceeding ·05 per cent. barium, but in amounts greater than this is toxic, and in excess will destroy the crop.

II. *Experiments on Acid Soils—the relative influence of Caustic Lime and Carbonate of Lime. Wheat. Second year*, 1917.

The general plan of this experiment—commenced in 1916—was given in last year's Report (vol. 77, 1916, pp. 257–8). The work was now carried on for the second year, no further applications being given, but wheat merely resown. The soil is the acid one of plot 2a of the continuous wheat series in Stackyard Field, where sulphate of ammonia alone had been used for many years. The applications were of lime and carbonate of lime respectively at rates of 1 ton, 2 tons, 3 tons and 4 tons per acre of lime or its equivalent in carbonate of lime. After the crop of 1916 the soil was taken out of the pots, the roots removed, the soil sieved and replaced, and wheat sown early in December, 1916. Germination was satisfactory even on the control pots to which no lime had been given, but the crop suffered much from the severe weather of January, February and March, 1917. Sulphate of ammonia at the rate of 1 cwt. per acre (as in the field) was given to all on May 16 ; this, it should be mentioned, was not done in the 1916 experiments.

As usual, the control sets (no lime), though coming up well, made little progress, and were very poor and short. The 2 tons, 3 tons and 4 tons of lime all were better than the 1 ton in the earlier stages, but, later on, as the lime application increased, the crop was shortened in length but became more leafy. The corn was ripe by August 13, and the appearances are well shown in Fig. 3, the harvest results being set out in Ta[illegible] XII.

The experiment with carbonate of lime in place of caustic lime was similarly conducted, and much the same appearances were observed, the heavier applications giving crops reduced in length but more leafy. The main point of difference was that in no case was the crop with carbonate of lime as good as the corresponding one with caustic lime. Fig. 4 shows the growing crops, and Table XII. gives the weighings along with those from the use of lime itself. Spurry—though allowed to grow—never came to much, and was not prominent as in 1916.

The gradual shortening of length of straw with increase of lime or carbonate of lime will be noticed from Table XII., this being more marked than in 1916. As regards yield, with lime the results were just the same as in 1916, 3 tons giving the best return both of corn and straw, this falling off slightly with the 4 tons application. With carbonate of lime, however, the yields were progressive as the applications increased. Practically, therefore, the results of 1916 were fully confirmed by those of 1917, showing that 1 ton of caustic lime or of the equivalent of this as carbonate of lime was insufficient, and that 3 tons per acre of lime or the equivalent of 4 tons of lime applied as carbonate of lime gave the best return, 4 tons of caustic lime being somewhat excessive.

The gradual increase in the percentage of nitrogen in the grain as more lime was given was, as in 1916, again noticeable.

TABLE XII.—*Lime and Carbonate of Lime on Acid Soil*, 1917.

Treatment	Length of Ear	Length of Straw	Weight of Corn	Weight of Straw	Percentage of Nitrogen in grain
	Inches	Inches	Grms	Grms	
Untreated .	43	7 3	25	1 45	2 58
Lime (CaO) 1 ton per acre	2 66	28 1	21 7	26 90	1 97
, 2 tons ,,	2 76	24 1	39 9	57 80	2 42
,, 3 ,, ,,	2 71	22 3	43 3	63 05	2 73
,, 4 ,, ,,	2 63	19 6	39 4	61 75	2 77
Carbonate of lime = 1 ton lime per acre	2 65	25 4	18 9	25 10	2 23
,, ,, = 2 tons , ,	2 79	22 4	28 5	36 90	2 64
, ,, = 3 ,, ,, ,	2 73	20·0	34 2	48 30	2 70
,, ,, = 4 ,, ,, ,,	2 61	19 3	34·6	53 45	2 70

III. *Felspar as a source of Potash.*

(*a*) *On Red Clover. Second Year*, 1917.

As stated in last year's report (Vol. 77, 1916, p. 257) the experiments conducted in 1916 with Felspar proved no more promising than those of earlier years, though a fresh crop, red clover, was tried. Up to then, however, the effects had only been tried on the crop of the year of the application of the felspar. It was now thought well to see whether, if the felspar were allowed to remain in the soil for a second year, it might not show some influence. Red clover having been grown in 1916, then showing, as stated, no differences from the use of felspar, it was decided to retain the pots as they were, and sow a second crop of red clover. No further application of felspar was given, and the only change made was that a little superphosphate was added to each pot. The different forms of application are set out in Table XIII., and were the same as in 1916.

The soil used was from Great Hill, a light sandy loam containing ·21 per cent. of potash (K_2O). The felspar contained 8·5 per cent. of potash, and was very finely ground.

The old clover plants of 1916 were removed, the surface soil stirred, and red clover sown on April 16, 1917. A good plant was obtained, and until July there were no differences to be seen. Then, however, the pots to which felspar or potash salts had been applied began to show marked superiority over the untreated. The crop was cut on July 26, and was then allowed to go on growing, a second cut being taken on October 5. Between these dates, unfortunately, continuance of wet weather obliged the keeping of the pots under cover, and many of the plants suffered, and the crop got uneven. Consequently the weighings of the second crop are not so satisfactory or reliable as those of the first crop. Still, it is thought better to give the results of both first and second crops, more especially as they both tend in the same direction. These results are given in Table XIII., and, for purposes of better comparison, they are stated in terms of the dry matter obtained in each crop.

TABLE XIII.—*Felspar on Red Clover. Second year*, 1917.

Treatment	First crop		Second crop		First and second crops	
	Total dry matter	Percentage of untreated	Total dry matter	Percentage of untreated	Total dry matter	Percentage of untreated
	Grms		Grms		Grms	
1 No treatment .	51 74	100	27 23	100	78 97	100
2 Felspar 10 cwt. per acre	70 98	137·2	29 01	106 5	99 99	126 6
3 Felspar 10 " " Common salt 2 " ,	70·44	136 1	30 62	112·4	101·06	128 0
4 Common salt 2 " ,	49 38	95 4	26·27	96·4	75·65	95·8
5 Felspar 10 " " Lime 5 " "	72·94	141·0	34 87	128·0	107 81	136·5
6. Lime 5 " "	55·10	106 5	25 96	95·3	81·06	102·6
7 Sulphate of potash containing the same potash as in 10 cwts. felspar. .	71·01	137·2	37·52	137·8	108 53	137·4

From these figures it will be seen that in every case of the application of felspar, whether used alone or with salt or with lime, there was an increase of yield, this ranging from 26 to 36 per cent.; also that the increase was not much less than that obtained from using sulphate of potash containing the same amount of potash as the felspar (8·5 per cent.). Further, the comparison of Nos. 4 and 6 with the rest showed that the increases obtained were not the result of using the salt or the lime, these when used alone showing practically no benefit. On the whole, the mixing of lime with felspar answered best.

It would, accordingly, appear that the felspar, though it failed to show any result in the first year of its application, yet if left for a second year seemed then to come into action, and to produce a beneficial result on a soil poor in potash.

(*b*) *On Mustard and Barley. First Year*, 1917.

Simultaneously with the foregoing, two other series of experiments with felspar were tried, the crops being respectively mustard and barley. In these the same felspar, but in larger amount, viz., at the rate of 1 ton per acre, was used. Also there was some alteration in the combinations with the felspar, lime being again employed, but sulphate of soda and sulphate of magnesia were used in place of common salt. These new sets, it will be borne in mind, were with felspar in its *first* year of application.

It is unnecessary to set out the results in detail, for it is sufficient to say that with neither crop, nor with felspar in any form of combination, was there any benefit shown, the results not differing from one another by more than what is attributable to experimental error. In short, the earlier results obtained in these experiments with felspar were exactly confirmed, and showed that in its *first* year of application felspar exercises no benefit. These two series will be allowed to go on for another year, in order to see whether the felspar shows, as with the red clover, any beneficial result in the *second* year.

IV. *Experiments on Nitrolim and Dicyandiamide.*

In the Report for 1916 is given an account of experiments conducted then on the use of ordinary and of "granular" nitrolim on wheat (this granular nitrolim containing 70 per cent. of its nitrogen as dicyandiamide), and also of dicyandiamide itself, a body known to be sometimes present in nitrolim and believed to be of harmful nature. The general results then were that the ordinary nitrolim did, on the whole, the best, and that though dicyandiamide, used by itself, was not as successful as the other two materials, yet, with the wheat crop, it could not be said that any marked harmful effect from its application was shown.

It was considered desirable, however, to repeat the experiment in 1917, and this was done, barley being now taken in place of wheat, and also a mustard crop was grown, as it has been stated by some that dicyandiamide, while not markedly toxic to cereals, is so to mustard. In 1916 the three materials were used at the rates of 1 cwt. and 2 cwt. per acre, alike before sowing, at sowing, and subsequently as top-dressings. In 1917 the experiments were confined to application at sowing and to top-dressing, but the amounts of each material used were in some cases extended to 1 cwt., 2 cwt., and 3 cwt. per acre. The soil used was the same as that employed in 1916, and to each pot was given superphosphate at the rate of 4 cwt. per acre and sulphate of potash at that of 2 cwt. per acre, these being mixed intimately with the soil. The nitrolims used were the same as in 1916, viz. —

Ordinary nitrolim	containing	17 90	per cent of nitrogen
Granular nitrolim	,	14 58	, , ,
Dicyandiamide (96·5 per cent pure)	,,	64 20	,, ,, ,,

The dicyandiamide was applied in amount to give the equivalent of the nitrogen in the granular nitrolim, 1 cwt. per acre of the latter being equivalent to ·23 cwt per acre of dicyandiamide. All the experiments were carried out in duplicate.

(a) *Barley.*

This series was started on April 6, 1917, the nitrolim, &c. where used at time of sowing, being mixed with the top 4 lb. of soil, and being limited to 1 cwt. per acre. The barley germinated well, all the 12 seeds sown coming up in each case; these were subsequently singled to 6.

The top-dressings, where applied, were given on May 24, after singling of the plants. They were, as before, limited to 1 cwt. per acre.

The first observation to be noted was that when the plants were about a fortnight old those which had had granular nitrolim or dicyandiamide at sowing began to show signs of withering at the leaf tips, though the plant's growth did not seem to be affected. This was not the case with the ordinary nitrolim, which at no time showed this effect, but pushed the plants on at once beyond the control plants. The granular nitrolim also showed superiority, though not so marked, to the controls, but the dicyandiamide at no time did this.

In the top-dressing series the applications were given, of course, on the surface, on May 24. In every case the leaves were, to some extent, injured. With the ordinary nitrolim this was confined to the leaves near the surface of the soil or those which the nitrolim had actually touched, and, after these had shrivelled up, the plants showed no further sign of injury, but with the granular nitrolim and dicyandiamide applications the injury showed itself at the leaf tips of all the plants more or less, and so continued to the end. The crop was cut on August 17. The weights of corn and straw obtained are given in Table XIV.

TABLE XIV.—*Ordinary and Granular Nitrolim and Dicyandiamide on Barley*, 1917.

	Applied at sowing				As top-dressing			
	Weight of corn	Percentage of untreated	Weight of straw	Percentage of untreated	Weight of corn	Percentage of untreated	Weight of straw	Percentage of untreated
	Grms.		Grms.		Grms.		Grms.	
Untreated	14·55	100	14·43	100	—	—	—	—
Ordinary nitrolim, 1 cwt. per acre	19·43	138·5	21·30	147·1	18·10	129·0	19·25	133·0
Granular nitrolim, 1 cwt. per acre	16·60	118·3	15·90	109·8	13·52	96·4	13·82	95·4
Dicyandiamide = 1 cwt. granular nitrolim per acre	14·75	105·1	12·70	87·7	12·90	92·0	12·20	84·3
Untreated (duplicate)	—	—	—	—	13·50	100	14·53	100

These results were very consistent, the several duplicates agreeing well. The general conclusion to be formed is that the ordinary nitrolim, as in 1916, was superior to the particular lot of granular nitrolim used (this containing, it will be remembered, 70 per cent. of its nitrogen as dicyandiamide) and to the dicyandiamide itself. The results were now more marked in this direction than in 1916, the ordinary nitrolim doing better and the granular worse than then. While the increases with ordinary nitrolim, alike in corn and straw, and whether applied at sowing or top-dressed, were satisfactory, the granular nitrolim gave a lesser increase when applied at sowing and a reduced yield—as compared with the untreated—when top-dressed; the dicyandiamide by itself gave, on the whole, a lower return all round than did no treatment. Putting together the results of the two years, one may say that the presence of dicyandiamide, whether used by itself or in the granular nitrolim, showed more injurious effects with barley than with wheat, and, as compared with ordinary nitrolim free from it, its presence cannot be considered desirable for corn crops.

It would also appear that nitrolim is more effective when applied early than when put on later as a top-dressing, though this is not quite in accord with the 1916 experiments, when, however, the results were less marked. The earlier application of nitrolim would avoid the scorching of the leaves noticed with the top-dressings.

(*b*) *Mustard.*

The experiments of 1917 were carried out with a mustard crop also. Mustard was sown on April 11—13, 1917, and, as with the barley, the three different applications were severally made at the time of sowing and as top-dressings also, in each case at the rate of 1 cwt. per acre. No harmful or other particular effect was noticed on the germination in any case. When, however, the plants appeared, the same observations as with the barley plants were made, the tips of the leaves withering where granular nitrolim or dicyandiamide was used, either at sowing or top-dressed, but no such effect being noticed with ordinary nitrolim. The latter quickly pushed the plants ahead of the control ones, but neither granular nitrolim nor dicyandiamide seemed to make much difference in them from the untreated sets.

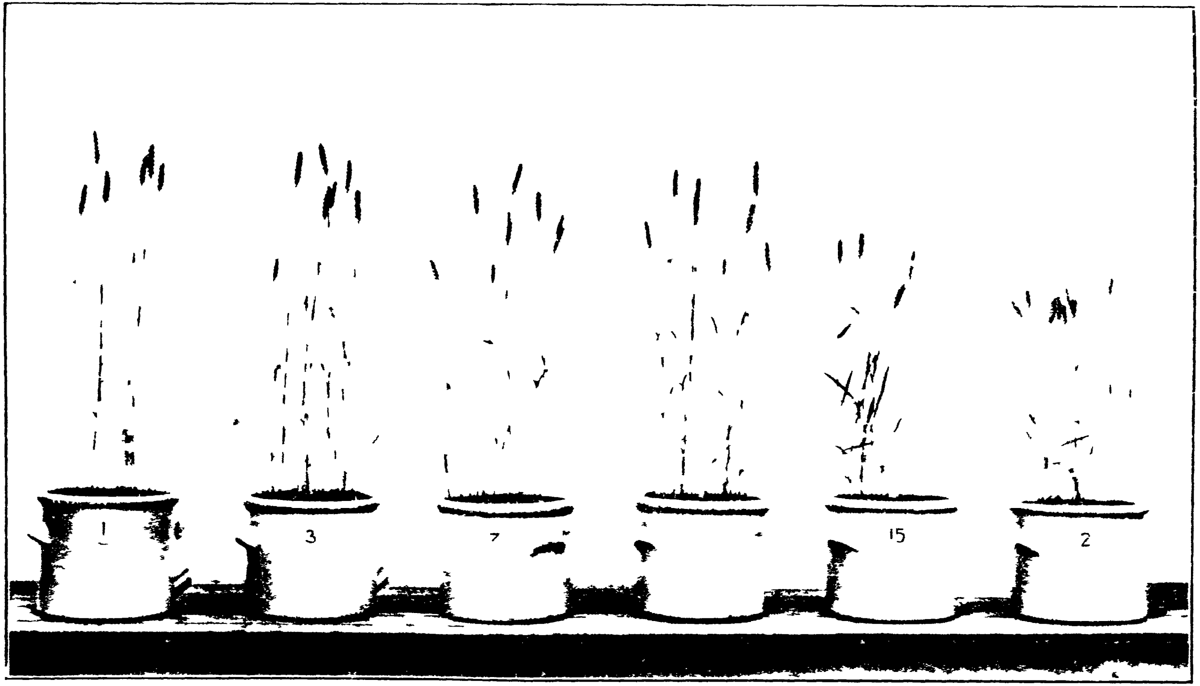
The first crop was ready by June 9 and cut green, the dry matter being subsequently ascertained and the results (given in Table XV.) set out according to this.

From these results it will be seen that with an application of 1 cwt per acre, the ordinary nitrolim did much the best, and gave a better crop when applied early. Both the granular nitrolim and dicyandiamide gave inferior crops to the control (the dicyandiamide particularly so) when applied at sowing, but a better return when top-dressed. In both ways of application, however, there was clear evidence of dicyandiamide exercising a harmful influence.

The roots were then removed, the surface soil stirred, and mustard again sown, this time with the different applications at the rate of 2 cwt. per acre. As before, the ordinary nitrolim pushed the plants on, but the granular nitrolim and dicyandiamide caused extensive withering of leaves and stunting of the plants. After a time, however, the plants seemed to recover from this, and, though it was still visible in the top-dressing series, it had nearly disappeared from the "at sowing" ones. The crop was cut on July 27.

Fig. 5 gives the appearance of the crops, and the weighings are recorded in Table XV. Here, with the 2 cwt. per acre dressing, the increase with ordinary nitrolim was greatly marked, the application at time of sowing being decidedly the better, while neither the granular nitrolim nor the dicyandiamide gave crops equal to the untreated, but showed a deteriorating influence.

Once again the roots were removed and the soil stirred, a third crop of mustard being sown on August 13, and this time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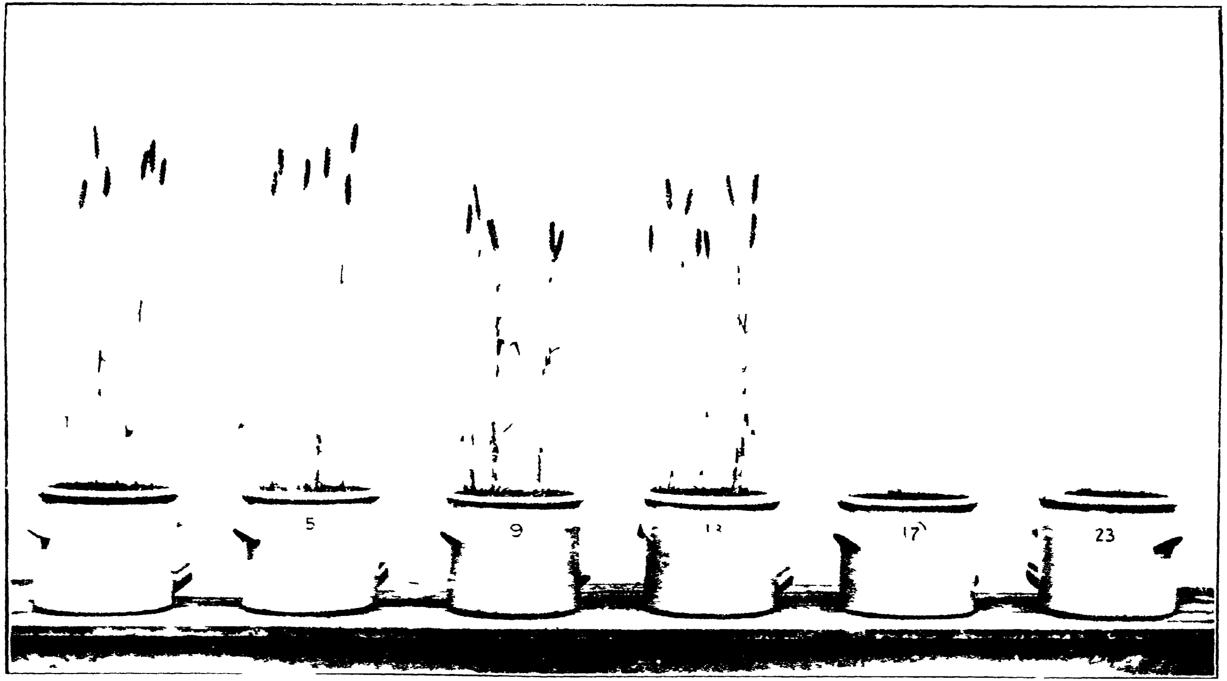
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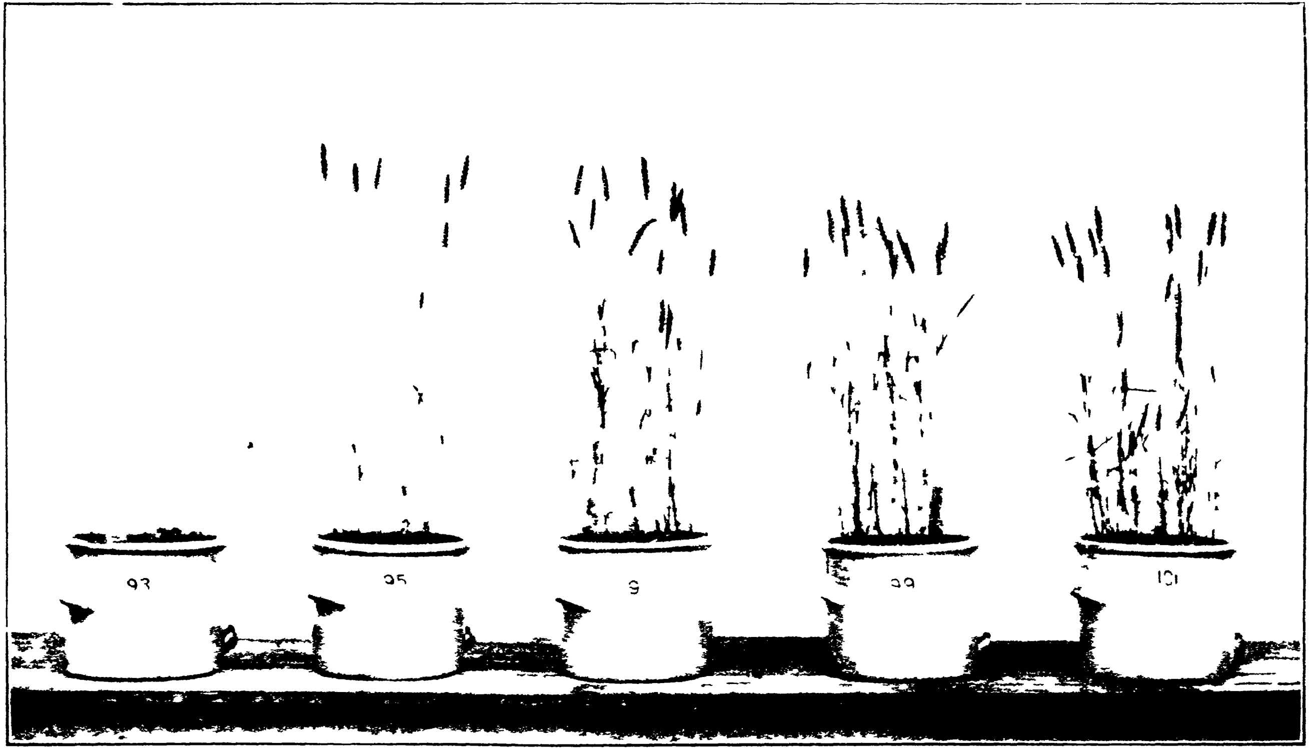
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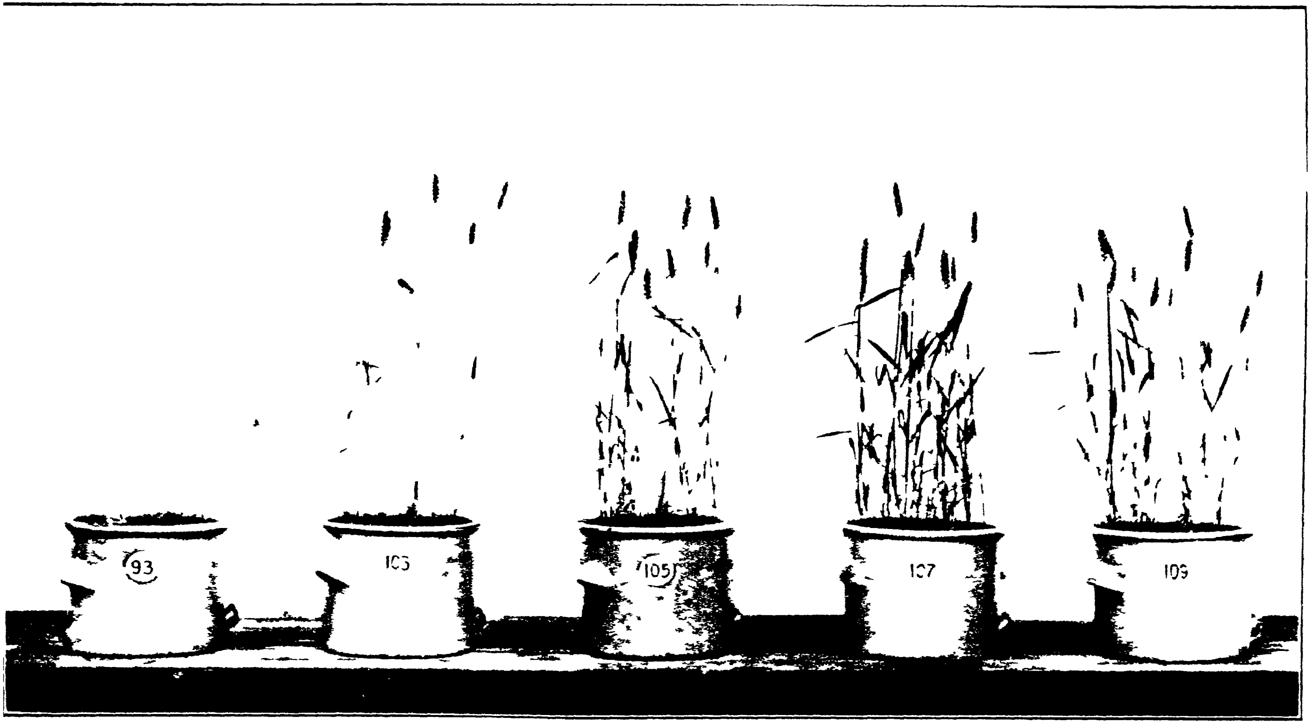
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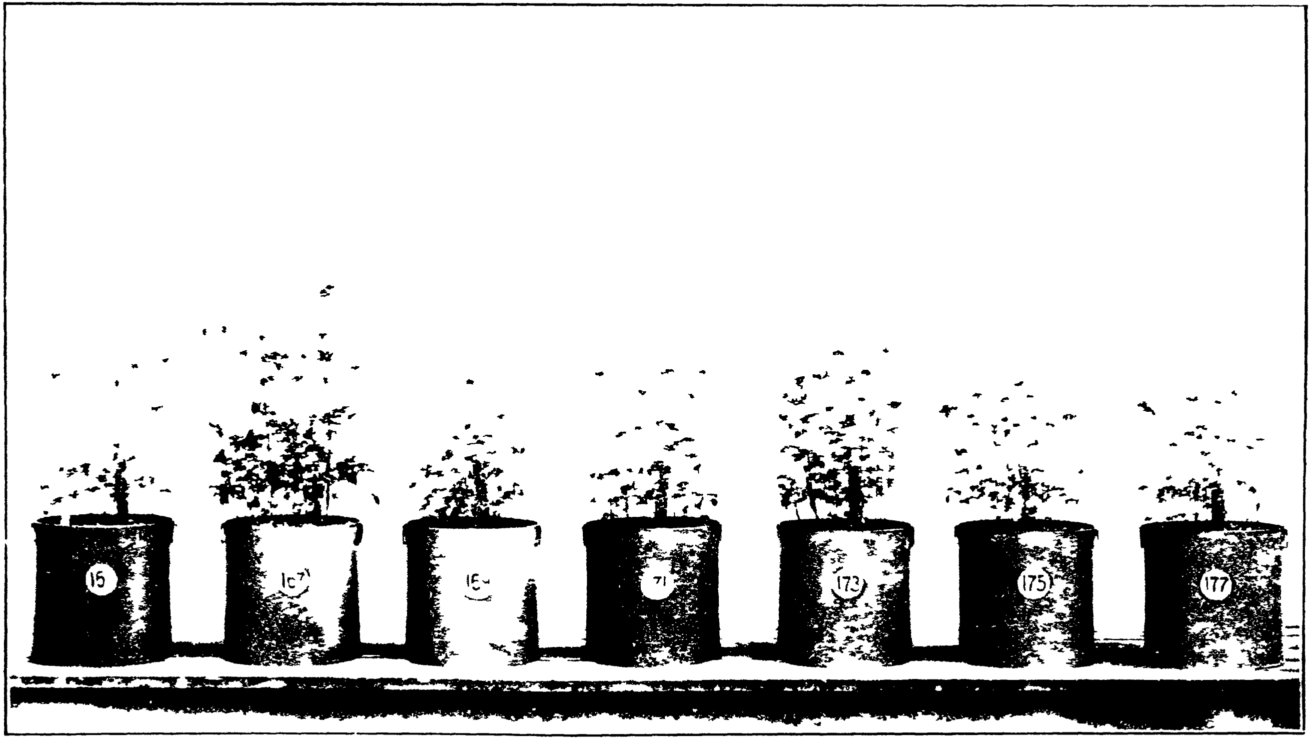
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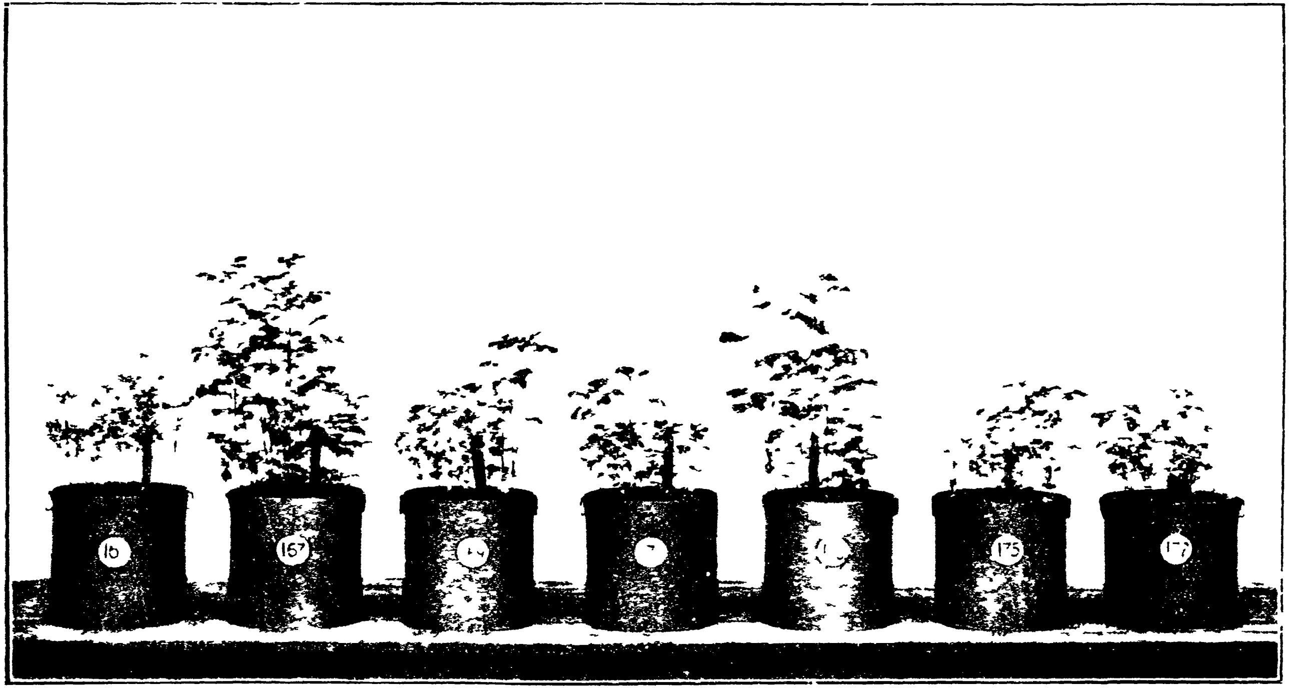
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the three several materials were applied, both at sowing and as top-dressings, at the rate of 3 cwt. per acre.

Now, however, a distinctly harmful influence on germination was shown with ordinary nitrolim used at this rate, only some 5—10 of the 40 seeds sown coming up in the first instance, and, though resowing was done, a full plant was never reached. What plants remained grew exceptionally vigorously, giving the appearances shown in Fig. 6 and the high results for the third crop set out in Table XV. But it was clear that the limit of profitable application had been overstepped with 3 cwt. per acre. Singularly enough, this harmful effect on germination was not shown to anything like the same extent with either granular nitrolim or dicyandiamide, though the same withering effects as with 2 cwt. per acre were again seen, and the resulting crops (see Table XV.) were not the equals of the control sets.

The top-dressings in every case, ordinary nitrolim included, produced much scorching, some of the weaker plants, indeed, being killed, and 3 cwt. per acre was clearly an excessive amount to use in either form. The results of weighing the third crop are given in Table XV., together with those of the preceding first and second crops, while Fig. 6 shows the third crop just before cutting it.

TABLE XV.—*Ordinary and Granular Nitrolim and Dicyandiamide on Mustard* 1917.

	First crop—1 cwt. per acre applications		Second crop 2 cwt. per acre applications		Third crop 3 cwt. per acre applications	
	Dry matter	Percentage of untreated	Dry matter	Percentage of untreated	Dry matter	Percentage of untreated
	Grms		Grms		Grms	
Untreated	13·17	100	11·04	100	14·87	100
Ordinary nitrolim at sowing	17·84	138·1	25·82	215·6	29·58	199·0
Granular nitrolim „ „	12·36	95·6	11·40	95·1	11·31	84·4
Dicyandiamide „ „	10·40	80·5	9·22	76·9	9·44	69·7
Ord. nitrolim as top-dressing	16·84	130·3	16·00	133·6	20·87	157·4
Gran. nitrolim „ „	14·48	112·0	9·79	81·7	7·12	51·6
Dicyandiamide „	12·44	96·3	9·25	77·2	6·24	45·2
Untreated (duplicate)	12·68	100	12·92	100	14·87	100

Putting the different results from the three crops together, it may fairly be established that it has been shown that nitrolim in any form must not be used at a higher rate than 2 cwt. per acre, or it will have an injurious effect upon the mustard crop. Used up to 2 cwt. per acre, however, ordinary nitrolim, free from dicyandiamide, has a marked beneficial effect, and this is greater from an early application of it (at sowing) than when used as a top-dressing. Further, that granular nitrolim, a considerable proportion of the nitrogen in which is in the dicyandiamide form, is not beneficial either at 1 cwt. or 2 cwt. per acre, and whether put on at time of sowing or top-dressed later, while dicyandiamide itself, in either amount, and in whichever way applied, has to some extent an injurious effect upon the mustard crop.

This injurious effect attributable to the presence of dicyandiamide is much more marked with mustard than with barley, and more so with barley than with wheat, which latter crop seems but slightly affected.

Averaging the results of application at time of sowing and top-dressing, the comparative effects of the three materials on the mustard crop are well brought out in Table XVI.

TABLE XVI.—*Average results of application (at sowing and as top-dressing) of Ordinary Nitrolim, Granular Nitrolim and Dicyandiamide on Mustard*, 1917.

	1 cwt per acre	2 cwt per acre	3 cwt per acre
Untreated	100	100	100
Ordinary nitrolim	134·2	174·6	178·2
Granular nitrolim	103·3	88·4	68·0
Dicyandiamide—gran nitrolim	88·4	77·0	57·4

In this the superiority of the ordinary nitrolim is clearly shown, as also the harmful effect of dicyandiamide as contained in granular nitrolim, and still more when used alone.

V. *The Use of "War-time" (nitre-cake) Superphosphate.*

In view of the shortage of oil of vitriol for ordinary superphosphate manufacture, and the call of the Board of Agriculture on manufacturers to make use of the waste nitre-cake obtained in nitric acid making, in order to supplement or replace oil of vitriol, it was considered desirable to try at Woburn superphosphate made in this way, and to see whether it acted at all injuriously on plants. Nitre-cake is mainly sulphate of soda, and may contain free sulphuric acid (H_2SO_4) up to about 30 per cent. There are mechanical difficulties in making superphosphate with it in place of oil of vitriol, but, by care, in some cases these have been partly overcome. For the purposes of the Woburn experiment a "war-time" superphosphate, as the material is called, was obtained which contained 12·60 per cent. of soluble phosphate with 1·31 per cent. of insoluble phosphate and 13·2 per cent. of water. This had been made by mixing the materials as follows:—Nitre-cake, 5 cwt; ground raw phosphate, 2 cwt.; water at 180° F., 1 cwt The acidity was 9·62 per cent. (reckoned as H_2SO_4). The experiment was carried out in two ways, firstly, by using nitre-cake by itself, and, secondly, by the use of nitre-cake superphosphate as described.

Nitre-cake by itself was tried on a barley crop at rates varying from 5 cwt. to 2 tons per acre, and in no case showed any signs of injury, even in the higher amounts

The nitre-cake superphosphate was used on barley and pea crops, in comparison with an ordinary superphosphate (28·61 per cent. "soluble") supplying the same amounts of soluble phosphate. The respective amounts supplied were 3 cwt. per acre of ordinary superphosphate, and 6·81 cwt. of the nitre-cake superphosphate, 1 cwt. of the ordinary superphosphate being equivalent to 2·27 cwt of the "war-time" superphosphate.

It is not necessary to go into the details of these experiments, as, with the exception that the nitre-cake seemed to retard germination at first, no special features were presented. It will suffice to say that, as regards the crop of the first year of application, there was nothing to indicate that any harm was being done to the crops or to the soil by the application of nitre-cake, either alone or as nitre-cake superphosphate, the produce with the "war-time" superphosphate being practically equal to that of the ordinary superphosphate supplying the same amount of soluble phosphate.

Whether the continued use of a material containing so much alkaline sulphates would eventually, by its accumulation in the soil, produce any harmful effects, would have to be ascertained in subsequent years. Meantime, however, the whole question has ceased to be of practical interest, owing to the Government, recognising the paramount importance of keeping up the production of superphosphate, having released sufficient oil of vitriol to meet the needs of manufacturers, and so the making of "war-time" superphosphate has been dropped for the time. It is satisfactory, however, to have been able to show, as has been done at Woburn, that, for a time, anyhow, no harmful effects need be anticipated from the use of such a material.

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WHAT IS THE BULK OF MANURE PRODUCED BY THE CONSUMPTION OF HAY?

A MANURE-MAKING EXPERIMENT CONDUCTED AT THE WOBURN EXPERIMENTAL FARM 1912-13 AND 1916-17.

IN many districts of the North of England a system of valuation prevails according to which, at the close of a tenancy, besides giving compensation to an out-going tenant for the unexhausted manurial value of purchased foods, there is, when the manure belongs to the out-going tenant, a further payment made to him on account of the *bulk* of manure left in the yards. Similarly, if an out-going tenant sells off hay during the last year of his tenancy, and so does not leave the ordinary bulk of manure in the yards, he is penalised, whilst, if he brings hay on to the farm and consumes it during the last year of his tenancy, he is, when the manure left belongs to him, repaid in the extra bulk of manure produced and valued according to the system in vogue. This extra payment for "bulk of manure" ranges, in normal times, between 3*s*. and 4*s*. per cubic yard of manure, according to its quality, and is intended to cover the value of the roots, hay and straw grown on the farm and consumed in the yards, as well as that of any hay that may have been brought on and consumed.

Without going into all the details of the position as between out-going tenant and landlord, according as whether the manure left in the yards belongs, by custom, to one or the other, it will suffice here to say that the whole question turns practically upon whether a ton of hay when consumed will produce five cubic yards of manure, more or less. The full situation is dealt with in detail in a paper by the present writer, entitled, "The Valuation of Manure produced by the Consumption of Hay," and issued in June, 1917, by the "Central Association of Agricultural and Tenant-right Valuers," 16, Halford Street, Leicester, and to which reference may be made. In the present article the question of the bulk of manure produced by the consumption of a ton of hay, &c., is alone dealt with, the experiments to decide this having been carried out at the Woburn Experimental Farm, on the representation of Mr. Christopher Middleton, of Darlington, himself a member of the R.A.S.E. Council. Mr. Middleton had frequently thrown great doubts upon the justice of the system, believing, as he did, that the extra manure produced by consuming a ton of hay was in reality considerably less in bulk than the five cubic yards assumed. He was therefore anxious that actual experiments should be carried out to settle authoritatively the point at issue, and this was accordingly done at Woburn, where there are specially constructed feeding-boxes or "pits," the floor and sides of which are cemented, so that loss of manure is reduced to a minimum and the measuring of the manure produced can be carried out with accuracy.

In the first experiment, carried out in the winter of 1912–13, two Shorthorn bullocks were put in boxes and fed on a mixed diet of beans and oats with roots and straw-chaff, two other bullocks being fed with the same kinds and quantities of food and with hay additional up to one ton, the same weight of litter being given to each set. The full details with results are given in Journal R.A.S.E., 1913, p. 410, and it will suffice here to say that, on measuring up the manure, the extra ton of hay consumed was found to have produced an extra bulk not of *five* cubic yards—but of 55·18 cubic feet or just over *two* cubic yards, so that Mr. Middleton's criticism of the system appeared to be justified.

Mr. Middleton was anxious, however, to have the experiment repeated, and also to have it extended so as to comprise not only the feeding of hay, but also that of cake and of some "bulky" food like dried grains or malt culms, inasmuch as he believed that any of these, and more especially the last named, would give nearly, if not quite, as much extra bulk of manure as would hay. These foods, it will be borne in mind, are fully compensated for according to scale, whereas with hay, when the manure belongs to the out-going tenant, it is only compensated for in the *extra bulk* of manure produced.

Eight Shorthorn bullocks, rather over two years old, were purchased at 19*l.* 17*s.* 6*d.* apiece in the last week of 1916, and the experiment was started on December 29, 1916 The bullocks were weighed and placed in the feeding boxes, two in each box, thus making four sets of two each. All the foods given them, as well as the water and the straw used for litter, were weighed and recorded. To each set the same amount of litter (barley straw) was given, a fresh supply being spread each day in the boxes. The foods compared were (*a*) hay, (*b*) cake, (*c*) malt culms. The cake was palm-nut cake, and malt culms were taken as the "bulky food," since they were cheaper at the time than dried grains, which it was originally intended to use.

The plan decided on was to have one set of bullocks consuming a "standard diet," a second with one ton of hay, a third with one ton of cake, and a fourth with one ton of malt culms, additional to the "standard diet."

The experiment, accordingly, was one in which the bullocks were looked upon, not from the feeding point of view, but purely as "manure-producers," in order to see what increased bulk of manure the consumption of a ton of hay, cake, or malt culms would produce.

As a matter of fact, though the hay lot and the cake lot of bullocks fed well and would have readily taken more food than allotted to them, the bullocks in the malt culms lot had difficulty in taking their full allowance, and so kept the other lots back. For a considerable time they would only take 5 lb. of malt culms per head daily, and evidently found the food very "bulky," and drank much more water than the other lots. As a consequence, the season getting late, the experiment was brought to a close on April 2 after half a ton of each of the selected materials had been consumed. This was after ninety-five days' feeding.

The respective amounts of food consumed in the ninety-five days by each set of two bullocks are given in Table I. :—

TABLE I.—*Food consumed by Bullocks.*

	Lot 1 'Standard diet only	Lot 2 Hay additional	Lot 3 Cake additional	Lot 4 Malt culms additional
	Lb	Lb	Lb.	Lb
Bean meal	190			
Maize	190			
Roots	3,971	Do	Do	Do
Chopped straw	767			
Hay	752			
Hay		1,120		
Cake			1,099	
Malt culms			–	1,101
Water	1,774	6,634	6,784	7,774
Litter	1,907	1,907	1,907	1,907

As already stated, the feeding boxes have the floors and sides cemented, so that there was no escape of urine, and the manure was made under the best possible conditions. It was not taken out at all during the progress of the experiment, but a little fresh litter was given each day, and the whole trodden down by the bullocks. After levelling down the surface when the feeding was over and the bullocks removed, it was comparatively easy to measure with fair accuracy the depth of the manure, this being done by taking a number of measurements at different points with an iron rod driven through the manure to the cemented floor, and averaging these. Applying this method the results as given in Table II. were obtained.

The results of this experiment, so far as the feeding with hay is concerned, are in agreement with those of the earlier experiment of 1912–13, an increased bulk of rather over two cubic yards of manure being then produced by the consumption of an additional ton of hay, and now 2·38 cubic yards extra being obtained. From this it follows that the estimate of five cubic yards additional for each ton of hay consumed, and on which the system which Mr. Middleton criticised is largely based, is clearly overstated.

TABLE II.—*Bulk of Manure produced.*

Lot	Food	Bulk of manure produced		Increase in bulk of manure produced	
				By consumption of ½ ton additional food	By consumption of 1 ton additional food
		Cubic ft	Cubic yds	Cubic yds	Cubic yds
1	"Standard" diet only	149·31	5·53		
2	Hay additional	181·44	6·72	1·19	2·38
3	Cake "	153·09	5·67	·14	·28
4	Malt culms additional	189·00	7·00	1·47	2·94

The following conclusions may be brought out from a consideration of the results of the experiment :—

1. A ton of hay, when consumed in the yards, will give 2·38 cubic yards of extra bulk of manure, or less than half the presumed amount, five cubic yards, adopted in some North-country valuations.
2. Cake consumed in yards produces but little increase of bulk in the manure, viz., only about ¼ cubic yard (7½ cubic feet) for every ton consumed.
3. Foods of bulky nature, like malt culms, dried grains, &c., produce an even greater bulk of manure than hay does (nearly three cubic yards for each ton consumed)
4. Feeding with malt culms or dried grains calls for more water to be given to bullocks than when hay is fed. The amount of water taken with cake and with hay is about the same in either case

TABLE III.—*Weights and Analyses of Manure produced.*

Lot	Food	Weight of manure				Analyses of manure			
						Water	Organic matter	Mineral matter	Nitrogen
		T	c	q	lb.	Per cent	Per cent	Per cent	Per cent
1	"Standard" diet only	3	14	1	14	74·73	21·05	4·22	·467
2	Hay additional[1]	4	6	3	7	75·00	20·77	4·23	·495
3	Cake "[1]	3	15	3	7	74·60	21·20	4·20	·750
4	Malt culms "[1]	4	16	0	7	77·13	19·08	3·79	·665

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[1] Half a ton consumed

The manure was, at the close of the experiment, removed from the several boxes, weighed, and subsequently analysed. The results are given in Table III.

The enriching of the manure by the feeding of cake, as also to a somewhat less extent by malt culms, will be noticed in the higher nitrogen contents. The taking of more water by the malt culms lot is further marked by the higher percentage of water in the dung.

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CALF-REARING EXPERIMENTS AT WOBURN.

A SUMMARY OF FOUR SETS OF EXPERIMENTS

CARRIED OUT AT THE

WOBURN EXPERIMENTAL FARM FROM 1912 TO 1917.

A DESIRE having been expressed that the results of the different experiments in Calf-rearing carried out at Woburn during recent years should be put together and briefly summarised, the following account is given.

At Woburn, on a separate farm known as "Charity Farm," there are about fifty acres of grass land, and here sheds have been erected with accommodation for about twenty-four calves. There are pens fixed up in the sheds and a space provided with a boiler and apparatus for the preparation of the foods. The calves (always bull calves of the Shorthorn breed) are purchased at Leighton Buzzard (Beds.) market when only three or four days old. They are purchased generally in two batches, twelve one week and twelve a fortnight later, and are brought direct to the farm and fed with whole milk for the first fortnight, after which they are weighed, divided up into the several lots, and then fed on the selected foods, the whole milk being gradually replaced by separated milk, and then the separated milk in turn dropped, when not forming part of the experiment. It is found that for the first fortnight the calves take about one gallon per head daily of whole milk. The feeding with the selected foods was carried on for nine weeks in the earlier, and for twelve weeks and fourteen weeks in the later experiments, after which the calves were weighed, and the figures obtained of their gain in live-weight and the cost of feeding.

The special feeding being concluded, all the calves are treated alike as regards food and conditions. If the experiment has been begun in the spring the calves are castrated and then turned out to grass in the late summer, having generally some cake, &c., given them; they are fed in the yards during the winter, being turned out in the day time and brought in at night; the following spring they are again turned out to grass and subsequently taken in to fatten, being killed at periods varying from twenty-two months to thirty months. When the experiment is with autumn-born calves, these are castrated at the close of the special feeding and fed alike, being kept in the sheds until the grass is ready for them in the spring. After the summer and autumn grazing they are brought into the covered yards for winter-feeding, and turned out to grass again the following spring, being finally fattened off in the yards.

The dry foods are put in mangers fitted up in the pens, this being found preferable to having the food in boxes on the floor; racks are also provided for hay, and the calves are allowed to nibble this as soon as ever they like. The water given to them always has the chill taken off first The hours of feeding are 7 a.m. and 3.30 p.m. The flooring is cement, and the pens are made with creosoted wood palings, the posts of which are let into sockets in the floor; the framework is merely hooked together so that the whole can be readily taken up and removed. The sockets are provided with covers to close them over, and the floors can then be thoroughly washed down and the building used as a single yard.

Special points noted as regards the preparation of the several foods are given later on, and it will suffice here to say that the methods adopted had to be varied considerably according to the food employed, some being taken best dry, others as cooked or made into a gruel. In some cases, as *e.g.* with palm-nut meal, special devices had to be resorted to in order to get the calves to eat the food freely.

The prices assigned to the several foods used were those which ruled at the time for these as delivered to the farm. Whole and separated milk were obtained from a neighbouring farm, the oats used were home-grown, the other foods all purchased Whole milk cost 7*d.* a gallon in 1912 (spring), 9*d.* per gallon in 1913 (autumn), 1*s.* per gallon in 1915 (autumn), and 1*s.* 6*d.* per gallon in 1916 (autumn). Separated milk was 2*d.* per gallon in 1912 and in 1913, and 3*d.* per gallon in 1915. The prices of all feeding stuffs rose greatly after the commencement of the war (August, 1914), so that the cost of feeding in the later experiments was considerably more than in the earlier ones. Similar fluctuations occurred in regard to the price of beef, so that the financial results ultimately obtained depended really more upon the particular time at which the purchases of food were made, the length of period that individual animals took to fatten, and the particular price ruling for beef at the time the cattle were slaughtered, than upon any intrinsic differences in the actual foods used at the outset. As a consequence of this it has been found impossible, with the exception of the first experiment—begun in spring, 1912, and concluded before the war broke out—to trace out fully the course of any experiment from its commencement to its conclusion at the slaughter of the animals, or to set out the financial results of the whole period, because any marked change, such as was frequently occurring in the price of feeding materials and in the market price of beef, was quite enough to throw the balance one way or the other, and in favour of this or the other feeding. For this reason it has been found necessary, except in the case of the first experiment (1912-14), to confine the consideration to the actual calf-rearing period, *i.e.* the time during which the calves were on the special foods, and not to follow them beyond this.

The several main questions set for decision were as follows :—

First Experiment, 1912-14.—How can separated milk be best utilised for calf-rearing (spring-born calves)?

Second Experiment, 1913-15.—How can separated milk be best utilised for calf-rearing (autumn-born calves)?

Third Experiment, 1915-17.—How can whole and separated milk be best dispensed with (single foods used)?

Fourth Experiment, 1916-18.—How can whole and separated milk be best dispensed with (mixture of foods used)?

I. First Experiment, 1912-14.

The account of this, with full details, has been already published in Journal R.A.S.E., Vol. 75 (1914), pp. 51—62, so that but a brief summary is here called for. The calves were spring-born ones, and cost, on March 26 and April 3, 1912, 2*l*. 6*s*. apiece. Whole milk was given them for three weeks, and then the special feeding for nine weeks. Separated milk was used in each case, and the purpose of the experiment was to see what additional food could best be used with it. The following were tried :—(1) Cod-liver oil; (2) calf meal (purchased); (3) gruel (linseed and oatmeal); (4) whole milk throughout; (5) crushed oats (given dry). There were four calves in each lot.

(1) Cod-liver oil. The cod-liver oil (cost 5*s*. 6*d*. per gallon) was stirred up with the separated milk (cost 2*d*. per gallon),

thus replacing the fat removed from the whole milk The four calves took, after a short time, 6 gallons of separated milk and 12 tablespoonfuls of cod-liver oil daily.

(2) Calf meal (cost 15*s*. per cwt.). Four calves took 4 gallons of separated milk and 2 gallons of calf meal daily

(3) Gruel. Linseed (cost 24*s*. per cwt.) and oatmeal (cost 17*s* per cwt) were made up into a gruel with water, and the separated milk then added. The four calves took up to 4 gallons of separated milk and 2 gallons of gruel daily (1 part linseed to 6 parts oatmeal)

(4) Whole milk (cost 7*d*. per gallon) 1½ gallons each calf daily.

(5) Crushed oats (cost 7*s*. per cwt.) Four calves took up to 6 gallons separated milk and 4 lb. oats daily

The special feeding commenced on April 16 and May 7 respectively.

No difficulty was found with any of the foods The calf meal was given according to the directions issued with it ; the oats were merely bruised in the farm mill, but not ground, and they were given *dry* and not mixed with the separated milk or made into a gruel. At the outset they were fed to the calves from the hand.

The results obtained on weighing the calves at the close of the nine weeks' special feeding are given in Table I

TABLE I.—*First Experiment*, 1912-14 (*Spring-born Calves*)

Cost of feeding and gain in live-weight

Lot	Food	Cost per calf per week		Gain per calf per week	Cost per lb of live weight gain
		s	*d*	lb	*d*
1	Cod-liver oil and separated milk	2	8 19	9 66	3 33
2	Calf meal , , ,	2	0	8 66	2 77
3	Linseed and oatmeal gruel and separated milk	2	4 77	8 33	3 15
4	Whole milk	5	9 22	12 83	5 39
5	Crushed oats and separated milk .	2	9 61	13 30	2 52

The crushed oats gave the highest gain and at the lowest cost per lb. of increase. It was clearly the best feeding material of those employed. Whole milk gave the next highest gain, but was considerably more expensive feeding. There was little to choose between the other three feedings.

When the calves had finished the nine weeks' special feeding (July 9, 1912) they were put together in the yard and all fed alike, and were carried on as described already until they were ready to kill. Intermediate weighings were taken of them

TABLE II.—*First Experiment.* 1912-14 (*Spring-born Calves*).

Average live and dead-weights gains in live-weight price realised at slaughter total cost and gain per head whole period)

Lot	Food	Average weights per head		Average gain in live weight per head	Average gain per head daily	Price realised per head at 5s per 8 lb stone	Initial cost and cost of feeding per head	Gain per head
		Live weight	Dead weight (8 lb stone)					
		C q lb	st lb	C q lb	Lb	£ s d	£ s d	£ s d
1	Cod-liver oil and separated milk	10 2 27	82 0	9 2 21	1 43	20 10 4	11 18 0	8 12 4
2	Calf meal ,,	10 3 9	83 0	9 3 3	1 46	20 15 4	13 19 10	6 15 6
3	Gruel ,	11 1 10	84 2	10 1 1	1 55	21 1 3	13 19 1	7 2 2
4	Whole milk (only)	11 1 8	86 5	10 0 26	1 66	21 13 1	13 16 11	7 16 2
5	Crushed oats and separated milk	12 0 7	91 7	10 3 19	1 55	23 0 5	12 6 6	10 13 11

when they were turned out to grass or brought into the yards. Up to the close of the experiment the same foods were given to all, and they were all run together. The bullocks were ready for killing at various dates between February and May, 1914. When ready, the live-weights and, after killing, the carcass-weights, were taken, and a summary of the general results is given in Table II.

It will be seen that the crushed oats lot maintained their advantage right to the end, giving the greatest daily gain throughout, and showing the best profit at the end. The crushed oats and the whole milk lots of bullocks were, on the whole, the first to be ready for killing, most of them being ripe at one year and ten months. The gruel and the calf meal lots were the longest in getting fat. As regards final profit the cod-liver oil lot stood next to the crushed oats, and then came whole milk, the appearance of the last named animals being the most "taking" to the eye, and the bullocks fed on crushed oats being second best in this respect.

The whole experiment showed very clearly what a good food crushed oats is to use with separated milk, and it is satisfactory to be able to state that, in no small measure as the outcome of this experiment, the practice of rearing calves on crushed oats has since widely extended.

II. SECOND EXPERIMENT, 1913–15.

The account of this experiment has been published in a leaflet issued in April, 1914. It was intended to be a repetition of the experiment of 1912–14, but using autumn born instead of spring born calves. The same foods as before were employed and a second "calf meal" introduced, there now being six pens of four each instead of five. Another modification was that the special feeding was kept on for twelve weeks instead of nine. On the other hand, owing to a difficulty in procuring all the foods, the calves were kept on longer on whole milk—four to five weeks instead of three—so that they were heavier than in the 1912–14 experiment when weighed and divided up for the special feeding. They came on the farm October 7 and October 14, 1913, and all had during the preliminary period a gallon of whole milk per head daily. The special feeding began on November 10, 1914, and the several lots were arranged as follows:—

Lot 1. Cod liver oil and separated milk.
2. Calf meal A ,,
3. Gruel (linseed and oatmeal) and separated milk.
4. Whole milk.
5. Crushed oats and separated milk.
6. Calf meal B ,,

The several foods were prepared and used just as in the first experiment already recorded. The costs varied somewhat, whole milk now costing 9*d.* per gallon, cod-liver oil 6*s.* per gallon, linseed 26*s.* per cwt., oatmeal 20*s.* per cwt., calf meal A 13*s.* 6*d.*, and calf meal B 15*s.* per cwt. The quantities taken of the respective foods did not differ materially from those previously recorded.

The calves were weighed at the close of the twelve weeks period (February 1, 1914), and the results are given in Table III.

TABLE III.—*Second Experiment*, 1913-15 (*Autumn-born Calves*).

Cost of feeding and gain in live-weight

Lot	Food	Cost per calf per week		Gain per calf per week	Cost per lb of live-weight gain
		s	*d.*	Lb	*d*
1	Cod-liver oil and separated milk	2	0 67	6 54	3 77
2	Calf meal A ,, , ,,	1	6 77	6 58	2 85
3	Linseed and oatmeal gruel and separated milk	2	0 89	5 71	4 35
4	Whole milk	5	3 93	8 29	7 71
5	Crushed oats and separated milk	2	0 19	8 29	2 92
6	Calf meal B , ,, ,,	1	7 44	6 20	3 13

Once more, crushed oats and whole milk gave the highest gains; the cost of feeding with whole milk was, however, much the highest, and the crushed oats came out best, the cost of feeding being practically as low as in any other case. Calf meal A occupied the second place, and cod-liver oil and calf meal B perhaps came next.

On comparing the first and second experiments it will be noticed that the gains were not as high in the second case as in the first This may have been due to the longer preliminary feeding with whole milk. Further, the financial result with whole milk is not as good as in 1912–14, owing to the higher price of milk.

After the twelve weeks of special feeding were over, the calves were put together and fed alike. They were turned out to grass in the spring of 1914, and fattened off as described. They were ready between December, 1915, and March, 1916. The live- and dead-weights were recorded as usual, and it was intended to make the final comparison when the bullocks were killed, and to set out the particulars just as was done in Table II This was, however, found to be quite impracticable, because of the marked changes in the prices of feeding stuffs that had taken place in the interval, and because of the great uncertainty as to the market price of fat cattle These factors were found to exercise a much greater influence in determining the financial results than did any difference in the feeding. For instance, the price of one lot of cake used was very different to the next, and the longer or shorter feeding of one animal as compared with another on expensive material of this kind easily threw the balance of profit (or loss) on one side or the other Consequently the attempt at tabulating the financial result had to be abandoned, and this and the subsequent experiments, though as a matter of fact carried out to the end, and with the live- and dead-weights of the bullocks recorded, have to be considered as closing, for comparative purposes, at the end of the period of special feeding, *i.e.* they have to be taken purely as calf *rearing* experiments.

The general result, however, it will be seen, was confirmatory of the 1912–14 experiment, and showed the advantage of using crushed oats along with separated milk.

III. THIRD EXPERIMENT, 1915–17.

There was no experiment in 1914 15, but the work was renewed in the autumn of 1915, and the account of the experiment is contained in a leaflet issued in March, 1916. This time a further and bold step was taken, the attempt being made to see whether even separated milk could be dispensed with. The increasing difficulties in connection with the supply of milk, even separated milk, on a farm where milking cows are not kept, led to this new experiment in which it was proposed to substitute, as early as possible, water for whole or separated milk

There were again twenty-four calves, to be divided into six lots of four each The calves came on October 19, and October 26, 1915, and were fed for the first fortnight on whole milk only. They were then weighed and divided up into the six lots decided on as follows :—

Lot	1	Crushed oats and separated milk
,	2	Calf meal and water
	3	Crushed oats and water
,,	4	Palm-nut meal and water
,	5.	Beans and water.
.,	6.	Maize and water.

Prices had risen greatly since the former experiment had been undertaken. Whole milk had gone up to 1*s*. per gallon, and separated milk to 3*d*. a gallon Oats were now 35*s*. per quarter (336 lb.), calf meal 20*s*. per cwt., palm-nut meal 9*l* 15*s*. per ton, beans 56*s*. per quarter (532 lb.), and maize 54*s* per quarter (480 lb.) on the farm.

The crushed oats and separated milk were retained in order to serve as a comparison with the earlier experiments. The calf meal was a different one to those used before. The beans and maize were "kibbled" but not ground, the maize was used scalded, but the beans, though at first scalded, were found to be more readily taken dry. The calves took the crushed oats and separated milk readily, also the calf meal (made into a gruel with water), but they would not take the crushed oats and water at first A little sugar mixed with the oats, however, removed this difficulty. With palm-nut meal there was considerable difficulty, and, after trying it scalded, and then made into a gruel, it was found to be best taken dry, the addition of a little hay chaff getting over the difficulty

Another change on the earlier experiments was that after eight weeks of the twelve weeks special feeding had been concluded, a little (½ lb. per head daily) linseed cake was given to all the lots in order to meet an objection raised that one would not feed calves on calf meal only for as long as twelve weeks.

The special feeding, which lasted for twelve weeks, began on November 3 and November 10, 1915, the calves having, as usual, been bought in two batches. The following notes were made as to foods consumed :—

(1) Crushed oats and separated milk.—The quantities given were practically one gallon of milk and 1 lb. of oats per head daily

(2) Calf meal and water.—4 lb up to 5 lb. of the meal were taken by the four calves daily, with three to four gallons of water.

(3) Crushed oats and water.—Sugar, as mentioned, had at first to be given to induce the calves to feed. Ultimately they took 3 lb. of oats to, at most, 4 lb. between the four, daily

(4) Palm-nut meal and water.—The mixing of the meal with a little hay chaff was found to be the best way of getting the palm-nut meal eaten. 4 lb. between the four was the general daily amount, and 5 lb was never exceeded.

(5) Beans and water.—The beans were taken most readily dry, and then the calves would take it greedily. Indeed, there was the fear of their eating it too freely, and the quantity had to be kept down to ¾ lb. per head daily.

(6) Maize and water.—5 lb. of maize daily between the four was the most given It was taken freely when scalded.

At the close of the twelve weeks' special feeding the calves were weighed, and Table IV. gives the general results.

The highest gain was obtained from the feeding with crushed oats and separated milk, and the next highest with palm-nut meal, despite the difficulty of getting the calves to take to it at first. After these came beans, then maize, and next crushed oats and water, calf meal giving the lowest gain of all. At first the calf meal lot did very well, but they did not keep up their good appearance.

TABLE IV.—*Third Experiment*, 1915-16.
Cost of Feeding and Gain in Live-weight.

Lot	Food	Cost per calf per week	Gain per calf per week	Cost per lb. of live-weight gain
		d.	lb.	*d.*
1	Crushed oats and separated milk	[illegible]	[illegible]·8	1·71
2	Calf meal with water	1[illegible]	2·8	[illegible]·96
3	Crushed oats and water	10·21	3[illegible]	2·71
4	Palm nut meal and water	10·2	[illegible]·00	1·70
5	Beans and water	[illegible]	[illegible]·6	2·14
6	Maize and water	1[illegible]	[illegible]	2·98

When cost was taken into account, palm nut meal was clearly the best, as it gave the second highest gain and at a cost considerably lower than any other food. Beans stood second, and then came oats and water and maize and water. Calf meal was the most expensive feeding and gave the lowest gain.

A comparison of lots 1 and 3 shows the benefit of using separated milk, but the cost was considerably increased thereby.

The experiment proved generally that separated milk could quite well be replaced by water, though at a lower gain in live-weight. The gains all round were less than in either 1912 or 1914, though, on the other hand, it must be remembered that the cost of separated milk had gone up meantime. The experiment brought out further, the use of a new food—palm nut meal—for calves, and if the difficulty of getting them to take to it well can be got over, a most useful food will have been introduced.

The calves were fed on, all receiving the same food from the conclusion of the special feeding. They were ultimately killed at different times from November, 1917, to February, 1918.

IV. FOURTH EXPERIMENT, 1916-18.

This experiment was, in a measure, a repetition of that of 1915-17, water being again used in place of separated milk. Separated milk was now dropped altogether. Instead, however, of using, as in 1915, single foods only, such as palm nut meal, beans, maize, &c., mixtures were in some cases employed, the several lots (six of four calves in each) being arranged as follows:—

Lot 1 Crushed oats and water
,, 2 Oats and beans with water
,, 3 Calf meal (fed dry) and water
,, 4 Palm-nut cake and oats with water
,, 5 Palm-nut cake with water
,, 6 Maize and fish meal with water

Whole milk had now gone up in price to 1*s.* 6*d.* per gallon, oats to 15*s* per cwt., beans to 14*s* 9*d* per cwt, calf meal first 24*s* then later 28*s.* per cwt, palm-nut cake to 11*l.* per ton, and maize to 14*s.* per cwt, while fish meal cost 17*s.* 6*d.* per cwt

The calves came to the farm on November 14 and November 28, 1916, and were fed for just a fortnight on whole milk only They then were put on the special feeding, and were kept to this for fourteen weeks, this being a longer period than in the earlier experiments.

The crushed oats, oats and beans mixture, palm-nut cake and oats, as also the calf meal and the maize and fish meal mixture, were all taken quite well, the last named in particular being relished, while the feeding of the calf meal *dry*, and not made into gruel, answered quite well Palm-nut *cake*, it should be mentioned, was used in this fourth experiment in place of *meal*, as it was found that the calves ate the cake better than the meal The cake was given broken into small lumps The one food with which difficulty was experienced was the palm-nut cake when used alone And here it was not, as in the 1915-17 experiment, that all the four calves alike refused it at first, but that the idiosyncrasies of individual animals came out, for, while two out of the four calves would take it quite well, the other two would not take it at all, and it was not until it was given to them mixed with some oats that they could be persuaded to feed. Once started with it, however, they went on with it, and would then take the palm-nut cake by itself.

(1) Crushed oats and water. Beginning with ¾ lb. oats daily between the four, after a week this was increased to 2 lb., then to 3 lb, and, after a month, to 4 lb, after two months to 5 lb between the four daily and thus to the end.

(2) Crushed oats and beans. 1 lb oats and ½ lb. beans daily to the four calves was given at first, and the quantities were gradually worked up to 4½ lb. oats and 1½ lb. beans daily.

(3) Calf meal. The four calves began at 1 lb daily, going then quickly to 4 lb., 5 lb, and, after six weeks, to 6 lb. daily between the four.

(4) Palm-nut cake and oats Starting with 1½ lb. of each daily between the four, 3 lb of each and finally 4 lb. of palm-nut cake and 5 lb. of oats were given to the set daily.

(5) Palm-nut cake alone The four calves took successively 1 lb., 1½ lb., 2 lb. (after four weeks), 3 lb. (after six weeks),

and then 4 lb. daily between the four This latter amount could not be increased.

(6) Maize and fish meal After ten days the four calves took 2 lb. maize and ½ lb. fish meal daily, after another week 4 lb maize and 1 lb fish meal, and, after six weeks and to the end, 5 lb. maize and 1½ lb fish meal daily

After the special feeding had been carried on for fourteen weeks the calves were weighed, and the general results of the experiment are set out in Table V

TABLE V.—*Fourth Experiment*, 1916-18

Cost of feeding and gain in live weight

Lot	Food	Cost per calf per week	Gain per calf per week	Cost per lb of live weight gain
		s. d.	lb	*d.*
	Crushed oats and water	1 2·[illegible]1	2·7[illegible]	5·15
2	Oats and beans with water	1 4·96	6·07	2·79
3	Calf meal (fed dry) and water	2 4·1[illegible]	[illegible]2	6·29
4	Palm nut cake and oats with water	1 7·21	7·33	2·62
5	Palm nut cake with water	10·81	4·71	2·29
6	Maize and fish meal	1 5·73	7·[illegible]6	2·41

The gains, as a whole, were more satisfactory than in the corresponding experiment of 1915-16 In particular the calf meal, fed dry, did better than when made into a gruel, the same calf meal was used in each case Palm nut cake used alone did not do so well as in 1915-16, mainly because of the difficulty in feeding two of the calves with it The gains with palm-nut cake and oats and with maize and fish meal were higher than any recorded in 1915-16, while the oats and beans mixture also stood well Crushed oats and water, however, showed a lower result than before, and gave the lowest gain of the foods in the series This may not improbably have been due to the difficulty experienced in obtaining good oats locally, those grown on the farm itself being of but poor quality

In general, therefore, it may be said that the result was in favour of a mixture of foods rather than of keeping to one individual food throughout

Taking cost into account, maize with fish meal and then palm-nut cake with oats stood at the top with highest live-weight gain and at lowest cost, after which came the oats and beans mixture Palm-nut cake, if it could be depended upon that the animals would take it, would prove as seen also in the 1915-16 experiment, a very cheap and good feed, but it clearly is better for being used along with other food Oats, again, while an excellent supplement to beans or palm nut cake, do not do well when merely given with water, though the earlier experiments showed them to be the best supplement, of those tried, to separated milk

GENERAL CONCLUSIONS

Had times been normal, it would have been possible to compare the four years' separate experiments, and to see how far the conclusions of one year were borne out in subsequent years in regard to cost But the altogether exceptional conditions render this impossible and the marked rise in prices of all kinds of food allows only of general deductions being drawn As instances of this may be mentioned the fact that in the first experiment (1912–14) whole milk was charged at 7*d* per gallon, and in the last (1916–18) at 1s 6*d* and that oats, which in the first case cost 7s per cwt were 15s per cwt in the last

A further bar to the institution of a close comparison is that in the first two experiments separated milk was given throughout but that in the last two it was replaced by water

The following general conclusions may, however, be drawn —

1. That it is not necessary to feed calves (coming when three to four days old) on whole milk for longer than the first fortnight
2. That when separated milk, for use subsequently, is not available, water can be quite well used in place of it, along with meals, and at considerably lower cost, though the gains in live-weight will not be so high
3. That the use of 'gruels' is not necessary but that, as a rule, foods are best given dry
4. That, as a supplement to separated milk, crushed oats are an excellent food, and will give as good a return as whole milk fed throughout and at a much lower cost
5. That, when used with water in place of separated milk crushed oats are not so good, but that, if water be used, beans, maize, or palm nut cake will do better
6. That palm-nut cake, while at times difficult to feed by itself, is an excellent food for calves and if supplemented by oats, will make as good a mixture as anything else
7. That when water is used in place of separated milk, a mixture of foods is preferable to the use of any one food by itself
8. That crushed oats form a good supplement to palm nut cake or to beans
9. That maize with fish meal is a good and economical mixture.
10. That purchased calf meals have not shown the special merits often attributed to them and are not necessary, nor, as a rule, economical

1 Tudor Street E C J A VOELCKER

Royal Agricultural Society of England.

(Established May 9th, 1838, as the ENGLISH AGRICULTURAL SOCIETY, *and incorporated by Royal Charter on March 26th, 1840.)*

Patron.

HIS MOST GRACIOUS MAJESTY THE KING

President for 1918.

HON. CECIL T. PARKER

Trustees.

Year when Elected on Council	
1905	ADEANE, C. R. W., C.B., *Babraham Hall, Cambridge.*
1895	BEDFORD, Duke of, K.G., *Woburn Abbey, Bedfordshire.*
1871	BOWEN-JONES, Sir J. B., Bart., *Council House Court, Shrewsbury.*
1893	CORNWALLIS, Col. F. S. W., *Linton Park, Maidstone, Kent.*
1885	COVENTRY, Earl of, *Croome Court, Severn Stoke, Worcestershire.*
1898	DEVONSHIRE, Duke of, K.G., *Government House, Ottawa, Canada.*
1904	GREENALL, Sir GILBERT, Bart., C.V.O., *Walton Hall, Warrington.*
1899	MIDDLETON, Lord, *Birdsall House, Malton, Yorks.*
1880	MORETON, Lord, *Sarsden House, Kingham, Oxford.*
1899	NORTHBROOK, Earl of, *Stratton, Micheldever, Hampshire.*
1881	PARKER, Hon. CECIL T., *The Grove, Corsham, Wiltshire.*
1881	THOROLD, Sir JOHN H., Bart., *Old Hall, Syston, Grantham.*

Vice-Presidents.

1887	CRUTCHLEY, PERCY, *Sunninghill Lodge, Ascot, Berkshire.*
1908	DERBY, Earl of, K.G., *Knowsley, Prescot, Lancashire.*
1891	DUGDALE, J. MARSHALL, *Llanfyllin, S.O., Mont.*
1903	FELLOWES, Rt. Hon. Sir AILWYN E., K.C.V.O., *Honingham, Norwich.*
1900	GREAVES, R. M., *Wern, Portmadoc, North Wales.*
1904	MATHEWS, ERNEST, *Little Shardeloes, Amersham, Bucks.*
1908	NORTHUMBERLAND, Duke of, K.G., *Alnwick Castle, Northumberland.*
1915	PORTLAND, Duke of, K.G., *Welbeck Abbey, Worksop, Notts.*
1914	POWIS, Earl of, *Powis Castle, Welshpool, Mont.*
1897	REYNARD, FREDERICK, *Sunderlandwick, Driffield, E. Yorks.*
1905	RICHMOND AND GORDON, Duke of, K.G., *Goodwood, Chichester.*
1907	YARBOROUGH, Earl of, *Brocklesby Park, Lincolnshire.*

Ordinary Members of the Council.

1910	ALEXANDER, D. T., *Brynaethen, Dinas Powis (Glamorganshire).*
1905	AVELING, THOMAS L., *Boley Hill House, Rochester (Kent).*
1911	BEHRENS, Major CLIVE, *Swinton Grange, Malton (Yorks, N. Riding).*
1906	BROCKLEHURST, HENRY DENT, *Sudeley Castle, Winchcombe (Glos.).*
1910	BROWN, DAVIS, *Marham Hall, Downham Market (Norfolk).*
1906	BULLAR, THOMAS A., *Corston, Coupar Angus (Scotland).*
1905	CARR, RICHARDSON, *Mill Lane, Burley, Ringwood, Hants (Hertfordshire).*
1913	CHAPMAN, W. W., *4 Mowbray House, Norfolk Street, W.C. 2 (London).*
1909	CROSS, Hon. JOHN E., *High Legh, Knutsford (Cheshire).*

Ordinary Members of the Council (*continued*)

Year when first elected on Council	
1917	CURRE, Col EDWARD, *Itton Court, Chepstow (Monmouthshire)*
1905	EADIE, JOHN T C, *Aldershawe, Lichfield, Staffs (Derbyshire)*
1911	EVANS, ARTHUR E, *Bronwylfa, Wrexham (North Wales)*
1913	EVENS, JOHN, *Burton, near Lincoln (Lincolnshire)*
1905	FALCONER, JAMES, *Northbrook Farm, Micheldever Station (Hampshire)*
1916	FITZHERBERT-BROCKHOLES, W, *Claughton Hall, Garstang (Lancs)*
1916	FRANCE-HAYHURST, Capt W H, *Bostock Hall, Middlewich (Cheshire)*
1907	FRANK, SIR HOWARD, K C B, *20 Hanover Square, W 1 (London)*
1909	GARNE, W T, *Aldsworth, Northleach (Gloucestershire)*
1916	GILBEY, Sir WALTER, Bart, *Elsenham Hall, Elsenham (Essex)*
1910	HARLECH, Lord, *Brogyntyn, Oswestry (Shropshire)*
1905	HARRIS, JOSEPH, *Brackenbrough Tower, Carlisle (Cumberland)*
1903	HARRISON, WILLIAM, *Albion Iron Works, Leigh (Lancashire)*
1909	HAZLERIGG, Sir ARTHUR G, Bart, *Noseley Hall (Leicestershire)*
1905	HISCOCK, ARTHUR, *Manor Farm, Motcombe, Shaftesbury (Dorset)*
1903	HOBBS, ROBERT W, *Kelmscott, Lechlade (Oxfordshire)*
1910	HOWARD, JOHN HOWARD, *Clapham Park, near Bedford (Bedfordshire)*
1905	INGRAM, WALTER L, *2 St Andrew's Place, Lewes (Sussex)*
1913	KELLY, Major DUNBAR, *Coombe Farm, Kingston-on-Thames (Surrey)*
19 5	KNIGHTLEY, Sir CHARLES V, Bart, *Fawsley, Daventry (Northants)*
1912	LANE FOX, Major G R, M P, *Bramham Park, Boston Spa (Yorks, W R)*
1909	LUDDINGTON, J L, *Littleport, Ely (Cambridgeshire)*
1909	MANSELL, ALFRED, *College Hill, Shrewsbury (Shropshire)*
1916	MANVERS, Earl, *Thoresby Park, Newark-on-Trent (Nottinghamshire)*
1904	MIDDLETON, CHRISTOPHER, *Lane Terrace, Darlington (Durham)*
1910	MIDWOOD, G NORRIS, *The Grange, North Rode, Congleton (Cheshire)*
1916	MOUNT, W. A, M P, *Wasing Place, Reading (Berkshire)*
1911	MYATT, JOHN, *Lynn House, Lichfield (Staffordshire)*
1915	OLIVER-BELLASIS, Capt R, *Shilton House, Coventry (Warwickshire)*
1910	OVERMAN, HENRY, *Weasenham, Swaffham (Norfolk)*
1909	PATTERSON, R G, *Coton Hill, Stafford (Staffordshire)*
1912	PERKIN, A W, *Greenford Green, Harrow (Middlesex)*
1906	PLUMPTRE, H FITZWALTER, *Goodnestone, near Canterbury (Kent)*
1916	PRICE, F HAMLYN, *11 Ormonde Terrace, Regent's Park, N W 8 (London)*
1909	RANKSBOROUGH, Lord, C V O, C B, *Ranksborough, Oakham (Rutland)*
1913	RAWLENCE, J E, *The Chantry, Wilton, Salisbury (Wiltshire)*
1905	REA, GEORGE GREY, *Doddington, Wooler, R S O (Northumberland)*
1916	ROGERS, ANDREW, *Great Woodford, Plympton (Devonshire)*
1897	ROGERS, C COLTMAN, *Stanage Park, Brampton Bryan (South Wales)*
1905	ROWELL, JOHN, *Bury, Huntingdon (Huntingdonshire)*
1913	SEWARD, Capt PERCY W, *Weston, Petersfield (Hampshire)*
1907	SMITH, FRED, *Deben Haugh, Woodbridge (Suffolk)*
1891	STANYFORTH, Lt Col E W, *Kirk Hammerton Hall, York (Yorks, W R)*
1912	STRACHIE, Lord, *Sutton Court, Pensford (Somerset)*
1916	THURSBY, Sir JOHN O S, Bt, *Ormerod House, Burnley (Lancashire)*
1907	TINDALL, C W, *Wainfleet, S O (Lincolnshire)*
1916	TRANT, BROOKING, *Trethawle, Liskeard (Cornwall)*
1904	TURNER, ARTHUR P, *Fayre Oakes, Hereford (Herefordshire)*
1889	WHEELER, Col E VINCENT V, *Newnham Court, Tenbury (Worcestershire)*
1915	WHITE, Capt J BELL, R N R, *Alderbourne Manor, Gerrards Cross (Buckinghamshire).*
1918	WICKHAM-BOYNTON, Capt T L, *Burton Agnes Hall, Driffield (Yorks E Riding)*
1889	WILSON, Col C W, *Rigmaden Park, Kirkby Lonsdale (Westmorland)*
1916	WRENCH, Rt Hon FREDERICK, *Killacoona, Ballybrack, Co Dublin (Ireland)*

STANDING COMMITTEES

⁎ Under By-law 39 the PRESIDENT is a Member *ex officio* of all Committees and the TRUSTEES and VICE-PRESIDENTS are Members *ex officio* of all Standing Committees except the Committee of Selection.

The Honorary Director is a Member ex officio of all Committees.

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MYALL, JOHN
OVERMAN HENRY
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FELLOWES Rt Hon Sir
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AVELING, T L
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HOWARD, J HOWARD
MIDWOOD, G NORRIS

And the Chairman of each of the Standing Committees

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CRUTCHLEY PERCY
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GREAVES R M
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Capt R
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SMITH FRED
TRANT BROOKING
WHEELER, Col

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GREENALL, Sir G, Bart
THOROLD Sir J H, Bart
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* *Scientific Members of Special Committee not Members of Council*

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Richmond and Gordon, Duke of
Northbrook, Earl of
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Thorold, Sir J. H., Bart.
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Evens, John
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Howard, J. Howard
Luddington, J. L.
Mansell, Alfred
Mathews, Ernest
Middleton, C.
Overman, H.
Patterson, R. G.
Rowell, John
Tindall, C. W.
Price, T. Hamlyn (*Hon. Secretary*)

Honorary Director. Sir Gilbert Greenall, Bart., C.V.O.

Secretary. Thomas McRow, 16 Bedford Square, W.C. 1.

Editor of Journal.—C. S. Orwin, Hon. M.A., *Agricultural Economics Institute, Oxford*.
Consulting Chemist.—Dr. J. Augustus Voelcker, M.A., F.I.C., 1 *Tudor Street, London, E.C. 4*.
Consulting Veterinary Surgeon.—Prof. Sir John McFadyean, *Royal Veterinary College, Camden Town, N.W. 1*.
Botanist.—Professor R. H. Biffen, F.R.S., *School of Agriculture, Cambridge*.
Zoologist.—Cecil Warburton, M.A., *School of Agriculture, Cambridge*.
Consulting Engineer.—F. S. Courtney, 25 *Victoria Street, Westminster*, S.W. 1.
Surveyor.—J. R. Naylor, F.R.I.B.A., *Smith's Bank Chambers, Derby*.
Publisher.—John Murray, 50A *Albemarle Street*, W. 1.
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Bankers.—The London County and Westminster Bank, *St. James's Square*.

DISTRIBUTION OF GOVERNORS AND MEMBERS OF THE SOCIETY, AND OF ORDINARY MEMBERS OF THE COUNCIL

Electoral District	Division	Number of Governors and Members	Number of Ordinary Members of Council	Ordinary Members of Council
A.	Bedfordshire	80	1	J H Howard
	Cheshire	553	3	Hon J E Cross, Capt W H France Hayhurst, G Norris Midwood
	Cornwall	98	1	Brooking Trant
	Derbyshire	168	1	J T C Eadie
	Dorset	98	1	A Hiscock
	Hampshire and Channel Islands	341	2	J Falconer, Capt Percy Seward
	Hertfordshire	215	1	Richardson Carr
	Lancashire and Isle of Man	522	3	W Fitzherbert Brockholes, W Harrison, Sir John O S Thursby
	Middlesex	103	1	A W Perkin
	Monmouthshire	92	1	Col Edward Curre
	Norfolk	488	2	Davis Brown, Henry Overman
	Northamptonshire	203	1	Sir C V Knightley
	Northumberland	255	1	G G Rea
	Staffordshire	304	2	John Myatt, R G Patterson
	Worcestershire	208	1	Col E V V Wheeler
	Yorkshire, N R	178	1	Major Clive Behrens
	Scotland	226	1	T A Buttar
		— 4 135	24	
B.	Buckinghamshire	157	1	Capt J Bell White R N R
	Devon	186	1	Andrew Rogers
	Durham	146	1	C Middleton
	Essex	217	1	Sir Walter Gilbey
	Herefordshire	151	1	A P Turner
	Leicestershire	170	1	Sir A G Hazlerigg
	London	523		W W Chapman, Sir Howard Frank, F Hamlyn Price
	Nottinghamshire	197	1	Earl Manvers
	Rutland	21	1	Lord Ranksborough
	Shropshire	411	2	Lord Harlech, Alfred Mansell
	Suffolk	218	1	Fred Smith
	Surrey	227	1	Major Dunbar Kelly
	Wiltshire	180	1	James E Rawlence
	Yorkshire, W R	347	2	Major G R Lane Fox, M P, Lt Col F W Stanyforth
	South Wales	147	1	C C Rogers
		— 3 301	— 19	
C	Berkshire	187	1	W A Mount M P
	Cambridgeshire	212	1	J L Luddington
	Cumberland	127	1	Joseph Harris
	Glamorgan	106	1	D T Alexander
	Gloucestershire	315	2	H D Brocklehurst, W T Garne
	Huntingdonshire	43	1	John Rowell
	Kent	357	2	T L Aveling, H F Plumptre
	Lincolnshire	343	2	John Evens, C W Tindall
	Oxfordshire	176	1	R W Hobbs
	Somerset	175	1	Lord Strachie
	Sussex	328	1	W F Ingram
	Warwickshire	234	1	Capt R Oliver Bellasis
	Westmorland	66	1	Col C W Wilson
	Yorkshire, E R	153	1	Capt T L Wickham Boynton
	Ireland	114	1	Right Hon F Wrench
	North Wales	287	1	A E Evans
		— 3 223	— 19	
Foreign Countries		274		
Members with no Addresses		22		
Grand Totals		10 955	62	

TABLE SHOWING THE NUMBER OF GOVERNORS AND MEMBERS IN EACH YEAR FROM THE ESTABLISHMENT OF THE SOCIETY.

Year ending with Show of	President of the Year	Governors		Members			Total
		Life	Annual	Life	Annual	Honorary	
1839	3rd Earl Spencer	—	—	—	—	—	1,100
1840	5th Duke of Richmond	86	189	146	2,434	5	2,860
1841	Mr Philip Pusey	91	219	231	4,047	7	4,595
1842	Mr. Henry Handley	101	211	328	5,194	15	5,849
1843	4th Earl of Hardwicke	94	209	429	6 155	15	6,902
1844	3rd Earl Spencer	95	214	443	6,161	15	6,927
1845	5th Duke of Richmond	94	198	527	5 899	15	6,733
1846	1st Viscount Portman	92	201	554	6,105	19	6,971
1847	6th Earl of Egmont	91	195	607	5,478	20	6,391
1848	2nd Earl of Yarborough	93	186	648	5,387	21	6,335
1849	3rd Earl of Chichester	89	178	582	4 643	20	5,512
1850	4th Marquis of Downshire	90	169	627	4,356	19	5,261
1851	5th Duke of Richmond	91	162	674	4,175	19	5,121
1852	2nd Earl of Ducie	93	156	711	4,002	19	4,981
1853	2nd Lord Ashburton	90	147	739	3 928	19	4,923
1854	Mr Philip Pusey	88	146	771	4,152	20	5,177
1855	Mr William Miles, M P	89	141	795	3 838	19	4,882
1856	1st Viscount Portman	85	139	830	3,896	20	4,979
1857	Viscount Ossington	83	137	896	3 933	19	5,068
1858	6th Lord Berners	81	133	904	4 010	18	5,146
1859	7th Duke of Marlborough	78	130	927	4,008	18	5,161
1860	5th Lord Walsingham	72	119	927	4 047	18	5,183
1861	3rd Earl of Powis	81	90	1,113	3,328	18	4,630
1862	H R H The Prince Consort 1st Viscount Portman	83	97	1 151	3,475	17	4,823
1863	Viscount Eversley	80	88	1,263	3 735	17	5,183
1864	2nd Lord Feversham	78	45	1 343	4 013	17	5,496
1865	Sir E C Kerrison Bart M P	79	81	1,386	4,190	16	5,752
1866	1st Lord Tredegar	79	84	1 395	4,019	15	5,622
1867	Mr H S Thompson	77	82	1,388	3 903	15	5,465
1868	6th Duke of Richmond	75	74	1,409	3,888	15	5,461
1869	H R H The Prince of Wales K G	75	73	1 417	3 864	17	5,446
1870	7th Duke of Devonshire	74	74	1,511	3,764	15	5,438
1871	6th Lord Vernon	72	74	1,589	3 890	17	5,642
1872	Sir W W Wynn, Bart, M P	71	73	1 655	3,953	14	5,766
1873	Earl Cathcart	74	62	1,832	3 936	12	5,916
1874	Mr Edward Holland	76	58	1,944	3,756	12	5,846
1875	Viscount Bridport	79	79	2 058	3,918	11	6,145
1876	2nd Lord Chesham	83	78	2 164	4,013	11	6,349
1877	Lord Skelmersdale	81	76	2 239	4 073	17	6,486
1878	Col Kingscote C B M P	81	72	2 328	4 130	26	6,637
1879	H R H The Prince of Wales K G	81	72	2,453	4,700	26	7,332
1880	9th Duke of Bedford	83	70	2,673	5,083	20	7,929
1881	Mr William Wells	85	69	2 765	5 041	19	7 979
1882	Mr John Dent Dent	82	71	2,849	5 059	19	8,080
1883	6th Duke of Richmond and Gordon	78	71	2,979	4,952	19	8 099
1884	Sir Brandreth Gibbs	72	72	3 203	5 408	21	8 776
1885	Sir M Lopes Bart M P	71	69	3,356	5 619	20	9,135
1886	H R H The Prince of Wales K G	70	61	3,414	5,569	20	9 134
1887	Lord Egerton of Tatton	71	64	3,440	5,387	20	8,982
1888	Sir M W Ridley Bart, M P	66	56	3,521	5,225	16	8,884
1889	HER MAJESTY QUEEN VICTORIA	73	58	3,567	7,153	15	10,866
1890	Lord Moreton	122	58	3,846	6,941	17	10 984
1891	2nd Earl of Ravensworth	117	60	3,811	6 921	19	10,928
1892	1st Earl of Feversham	111	69	3,784	7,066	20	11,050
1893	1st Duke of Westminster, K G	107	74	3,786	7 138	21	11,126
1894	8th Duke of Devonshire, K G	113	73	3,798	7,212	22	11,218
1895	Sir J H Thorold, Bart	120	80	3,747	7,179	23	11,149
1896	Sir Walter Gilbey, Bart	126	83	3,695	7,253	23	11,180
1897	H R H. The Duke of York, K G	126	83	3,705	7,285	24	11,223
1898	5th Earl Spencer, K G	121	79	3,687	7,182	25	11,094
1899	Earl of Coventry	116	75	3,656	7,009	23	10,879
1900	H R H The Prince of Wales, K G	111	71	3,628	6,832	24	10,666
1901	3rd Earl Cawdor	102	70	3,564	6,338	27	10,033
1902	H R H Prince Christian, K.G	100	69	3,500	5,955	26	9,650
1903	H R H The Prince of Wales, K G	99	62	3,439	5,771	27	9,398
1904	16th Earl of Derby K G	96	68	3,375	5 906	32	9 477
1905	Lord Middleton	89	78	3,212	5,758	33	9,170
1906	Mr F S W Cornwallis	94	155	3,132	6,189	30	9,600
1907	Earl of Yarborough	91	174	3,076	6,299	29	9,669
1908	Duke of Devonshire	89	178	3 019	6,442	30	9,758
1909	7th Earl of Jersey, G C B.	91	177	2,951	6,696	31	9,946
1910	Sir Gilbert Greenall Bart	86	166	2,878	6,934	31	10,095
1911	HIS MAJESTY KING GEORGE V.	85	168	2,805	7,191	30	10,279
1912	Lord Middleton	85	170	2,741	7,283	30	10,309
1913	Earl of Northbrook	89	168	2,691	7,474	26	10,448
1914	Earl of Powis	89	173	2,626	7,629	28	10,545
1915	Duke of Portland, K G.	88	184	2,517	7,313	28	10,130
1916	7th Duke of Richmond and Gordon, K G.	83	185	2,427	7,526	27	10,248
1917	Mr Charles R W Adeane, C B	93	210	2,412	8,214	26	10,955

STATEMENT made to the Council by the Chairman of the Finance Committee, on presenting the Accounts for the year 1917.

Mr. ADEANE, in presenting, on behalf of the Finance Committee, the Accounts of the Society for the year 1917, said it was satisfactory that the Society had emerged from a year such as 1917 with a credit balance on the ordinary account of 819*l.*, proving that the financial position was sound. On the income side there were two features deserving notice. One was that there was an increase in the amount from subscriptions, in spite of the fact that no show had been held, and the figure would have been even greater but for their practice to credit the subscriptions of members elected after the July Council meeting of any year to the succeeding year. There had been thirteen Governors and 582 members elected after July 25 last year. Another matter to which he would call attention was that the interest from investments was steadily increasing, and they were now feeling the benefit of the sound policy adopted thirteen years ago of building up a reserve fund.

The total increase of income for the year was 660*l.* This amount practically balanced the increase on the side of expenditure, which amounted to 692*l.*, due to the cost for appealing for new members, the grant to the Reading Research Institute, the expenses of the War Emergency Committee, and the issue of the "Occasional Notes."

Turning to the balance-sheet, the Society's capital stood at 58,392*l.*, and showed an increase of 3,264*l.* That sum included 1,365*l.* received during 1917 as compositions by new members, and this compared very favourably with 506*l.* in the preceding year. On investments there was some depreciation at present prices, but as they were all terminable securities he thought they could regard fluctuations in price with complacency. They continued to write off liberally for depreciation of goods and chattels. One item—"expenditure on forthcoming Show at Cardiff"—required explanation. Altogether they had to find 4,645*l.* towards the expenses incurred at Cardiff, which amount had been divided into two sums of 1,201*l.* and 3,444*l.* respectively. The first of these was to meet charges of the contractors and salaries of Show officials which could not properly be debited to the Show account, and had been paid out of the 2,500*l.* annually set aside against loss on the Show. The other item of 3,444*l.* had been incurred in moving material from Manchester to Cardiff, and was in the nature of an advance which it was hoped would be repaid whenever the Show was held The reserve fund now stood at 50,742*l*, and he hoped they would all live to see that figure raised to 100,000*l* (Hear, hear.) He then presented the following —

FORECAST OF ORDINARY RECEIPTS AND EXPENDITURE FOR 1918

(Other than in respect of the Show)

Prepared by direction of the Finance Committee on the basis of the Recommendations of September 21 1905 made by the Special Committee

Actual Figures for 1917	*Receipts*	
£		£
8 511	From Subscriptions for 1918 of Governors and Members	8 700
21	From Interest on Daily Balances	100
1 890	From Interest on Investments	1 940
256	From Sales of Text Books Pamphlets &c	150
	(This does not include the sales of Journals which are deducted from the cost of production)	
10,678		10 890

	Expenditure	
£		£
1 55	Salary of Secretary and Official Staff	1 586
140	Pensions to Officials	140
839	Rent Lighting Cleaning Wages &c (say)	800
749	Printing and Stationery	700
344	Postage and Telegrams	300
232	Miscellaneous	250
880	Journal	880
710	Chemical Department	710
150	Contribution to Woburn Farm	150
100	Contribution to Hills Bequest	75
250	Botanical Department	250
203	Zoological Department	200
402	Veterinary Department	400
100	Grant to Research Institute University College Reading	100
53	Consulting Engineer	52
238	Examinations for National Diploma (R A S E Share)	220
2,500	Amount set aside towards Loss on Shows	2,500
9 441		9 313

	Exceptional Expenditure	
	Reprint of Society's Text Book	400
208	War Emergency Committee	200
142	Occasional Notes to Members	120
58	Library Assistance	100
—	Library Printing Catalogue and Purchase and Binding of Books	400
10	Board of Scientific Societies	
9 859		10,533

		£
	Estimated Receipts	10,890
	Estimated Expenditure	10,533
819	Estimated Receipts over Expenditure	357

With reference to the amount put down in the estimates for printing the catalogue of the library and the purchase and binding of books, Mr. Adeane said he would mention that this had been before the Journal Committee, and the view of that Committee was that, having regard to the high cost of paper, it would perhaps be better to wait before proceeding with the printing of the catalogue. Together with the other items in the estimate, it had also been considered by the Finance Committee, who felt that they would like to include this 400*l.* in the estimate but to leave it to the judgment of the Journal Committee to use that sum now or later as they thought best. Personally he felt that it was probable that the expense of printing would remain high for a long time, and if it was decided only to print when prices were reduced they might have to wait some years before they had their catalogue. There had been a considerable accession of new members to the Society, and he could not help feeling that it was important that they should have all branches of their activity as efficient as possible; therefore, as they had a fine library, they ought to have it properly catalogued and have that catalogue printed. Moreover, they hoped to sell copies, and thus some of the money would come back. If the Council decided to include that item, the total estimated receipts indicated a probable balance over expenditure of 357*l*., which, under present circumstances, he thought, was very satisfactory.

Royal Agricultural Society of England.

STATEMENT OF FUNDS HELD BY THE SOCIETY IN TRUST OR WHICH ARE NOT CONSIDERED AVAILABLE FOR GENERAL PURPOSES, DECEMBER 31, 1917.

	£ s. d.	£ s. d.
To Hills' Bequest for Pot-culture Experiments		9,000 0 0
Less: Depreciation of Consols at time of conversion	3,582 7 11	
Cost of conversion	134 14 7	
		3,717 2 6
		5,282 17 6

	£ s. d.	£ s. d.
By 5,560*l* 17*s* 8*d* 5% War Stock (1929-1947) received under the conversion rights for 5,282*l* 17*s* 6*d* 4½% War Stock . . .		5,282 17 6
(*Value on December* 31 1917, at 93¾=5,223*l* 4*s* 7*d*)		
		5,282 17 6

	£ s. d.	£ s. d.
To Fund provided by Sir Walter Gilbey for Endowment of Lectureship at Cambridge when after a certain date any balance on this account will become the property of the Society		1,141 5 1
		£1,141 5 1

	£ s. d.	£ s. d.
By 1,140*l* Metropolitan Water A Stock at cost		998 1 0
(*Value on December* 31, 1917 at 58=661*l* 4*s* 0*d*)		
By amount included in the Society's Sundry Creditors' Account —		
Fund uninvested	1 19 0	
Accumulated income	141 5 1	
		143 4 1
		£1,141 5 1

	£ s. d.	£ s. d.	£ s. d.
To Superannuation and Insurance Fund —			
Amount set aside in accordance with Declaration of Trust of July 26 1911 .		9,171 5 0	
Less Depreciation of Consols at time of conversion	1,837 18 4		
Cost of conversion	256 3 0		
		2,094 1 4	
			7,077 3 8
Income Tax payable on War Stock Interest			90 2 6
Accumulations to December 31 1917			598 3 8
			£7,765 9 10

	£ s. d.
By Investments in names of Trustees of Superannuation and Insurance Funds viz —	
7,449*l* 12*s* 4*d* 5% War Stock (1929-1947) received under the conversion rights for 7,077*l* 3*s* 8*d* 4½% War Stock	7,077 3 8
(*Value on December* 31 1917 at 93¾=6,984*l* 0*s* 4*d*)	
289*l* 9*s* 5*d* West Australian 3½% Stock (1935-1955) at cost	247 19 0
(*Value on December* 31 1917 at 68½=198*l* 1*s* 9*d*)	
140*l* 4*s* 6*d* Queensland 3½% Stock (1950-1970) at cost	120 17 11
(*Value on December* 31 1917 at 66¾=93*l* 12*s* 0*d*.)	
Cash at Bank	319 9 3
	£7,765 9 10

Examined, audited, and found correct this 19th day of February, 1918

THOMAS McROW, *Secretary*

DELOITTE, PLENDER, GRIFFITHS & CO., *Accountants*

JONAS M. WEBB,
H. J. GREENWOOD, } *Auditors on behalf of the Society.*

ROYAL AGRICULTURAL

BALANCE SHEET

Dr.

Corresponding figures for 1916. £		£ s d	£ s d	£ s d
	To SUNDRY CREDITORS			
2 381	Sundry Creditors		2,664 12 7	
72	Subscriptions received in 1917 in advance		239 17 0	
2 453				2,904 9 7
	To CAPITAL			
47 031	As at December 30 1916		55 128 16 4	
	Show Fund			
	Amount set aside from Ordinary Account	2 500 0 0		
	Less Expenditure on Cardiff Show	1 201 12 1		
6 981			1 298 7 11	
506	Life Compositions received in 1917		1 365 0 0	
50	Donations towards the Society's Funds		51 0 0	
851	Credit balance on ordinary income and expenditure account		818 12 6	
55 419			58 661 16 9	
	DEPRECIATIONS written off, viz			
23	Fixtures	20 18 6		
84	Furniture	5 19 7		
5	Machinery	4 5 11		
128	Show Plant	117 14 1		
50	Buildings at Woburn	50 0 0		
290			268 18 4	
55 129				58,392 18 5
£57,582				£61,297 8 0

THOMAS McROW *Secretary*

DELOITTE PLENDER GRIFFITHS & CO *Accountants*

DECEMBER 31, 1917. *Cr.*

Corresponding figures for 1916 £		£	s	d	£	s.	d.
	By RESERVE FUND—						
35,409	37,272*l* 0*s*. 11*d*. 5 per cent War Stock (1929-1947) received, under the conversion rights, for 35,408*l* 13*s* 4*d* 4½ per cent War Stock				35,408	13	4
	(Value on December 31, 1917 @ 93¾ = 34,942*l* 10*s* 10*d*.)						
5,500	5,789 8*s* 9*d* 5 per cent War Stock (1929 1947) received, under the conversion rights, for 5,500*l* 6 per cent Exchequer Bonds				5,500	0	0
	(Value on December 31, 1917, @ 93¾ = 5,427*l* 12*s*.)						
–	1,088*l* 10*s* 4*d* 5 per cent. War Stock (1929 1947) at 95				1,034	1	11
	(Value on December 31, 1917, @ 93¾ = 1,020*l* 9*s* 8*d*.)						
2,500	2,840*l* 13*s* 6*d* Metropolitan 3 per cent Consolidated Stock (1941) at 87⅞				2,500	0	0
	(Value on December 31, 1917, @ 67½ = 1,917*l* 9*s* 1*d*.)						
6,300	6,528*l* 1*s* 6*d* Canadian 4 per cent Stock (1940 1960) at 96½				6,300	0	0
	(Value on December 31 1917, @ 81½ = 5,320*l* 7*s* 7*d*.)						
	By LEASE OF 16 BEDFORD SQUARE	2,000	0	0			
2,000	*Less* Amount written off	100	0	0	1,900	0	0
	By FIXTURES—						
	Value at December 30, 1916	278	19	9			
279	*Less* Depreciation at 7½ per cent	20	18	6	258	1	3
	By FURNITURE—						
	Value at December 30, 1916	759	15	10			
760	*Less* Depreciation at 10 per cent	75	19	7	683	16	3
1,500	By PICTURES (500*l*.) and BOOKS (1,000*l*.)				1,500	0	0
	By MACHINERY—						
	Value at December 30, 1916	42	19	11			
43	*Less* Depreciation at 10 per cent	4	5	11	38	14	0
	By SHOW PLANT—						
	Value at December 30, 1916	1,177	3	8			
1,177	*Less* Depreciation at 10 per cent	117	11	4	1,059	9	4
	By BUILDINGS FOR POT EXPERIMENTS AT WOBURN—						
	As per Account at December 30, 1916	150	0	0			
150	*Less* Depreciation	50	0	0	100	0	0
54	By EXPENDITURE ON FORTHCOMING SHOW AT CARDIFF (balance carried forward)				3,444	3	8
1,380	By SUNDRY DEBTORS				896	0	10
	By CASH AT BANKERS AND IN HAND—						
	Reserve Fund	175	0				
440	Ordinary Account	353	11	2			
90	In Hand	145	16	6	674	7	8
£57,582					£61,297	8	6

Examined, audited, and found correct, this 19th day of February, 1918

JONAS M. WEBB,
H. L. GREENWOOD } *Auditors on behalf of the Society*

STATEMENT OF ORDINARY INCOME

The Expenditure in this account includes not only cash payments,

Income.

Corresponding figures for 1916 £		£	s.	d.	£	s.	d.
	ANNUAL SUBSCRIPTIONS:—						
956	*Governors*: Subscriptions for 1917	1,073	12	6			
42	*Members*: Received in 1916, but belonging to 1917	72	5	0			
7,050	Subscriptions for 1917	7,176	7	6			
91	Subscriptions for 1917 (additional)	92	15	0			
83	Subscriptions for previous years	27	0	0			
	LIFE GOVERNORS AND MEMBERS:—						
71	Annual Contributions	69	3	0			
8,293					8,511	3	0
	MISCELLANEOUS:—						
143	Interest on Daily Balances	21	5	8			
1,466	Income from Investments	1,889	17	2			
25	Sales of Pamphlets, Diagrams, &c	18	16	4			
77	Sales of Text Book	222	1	0			
14	Miscellaneous	14	14	0			
1,725					2,166	14	2
	Rent of 12 Hanover Square	247	10	0			
	Less Rent paid	247	10	0			
£10,018					£10,677	17	2

THOMAS McROW, *Secretary*.
DELOITTE, PLENDER, GRIFFITHS & CO., *Accountants*.

AND EXPENDITURE FOR THE YEAR 1917.

but all liabilities in connection with the year's transactions

Expenditure.

Corresponding Figures for 1916				
£	**General Administration :—**		£ s d	£ s d
1 507	Salaries of Official Staff		1,554 18 0	
140	Pensions to Officials		140 0 0	
58	Legal Charges and Auditors Fees		60 7 6	
814	Rent, Rates, Taxes, Insurance, and House Expenses		838 12 3	
36	Purchase and Binding of Books		7 10 9	
574	Printing and Stationery		749 0 3	
186	Postage and Telegrams		333 19 11	
59	Carriage of Parcels and Travelling Expenses		66 1 2	
85	Advertising and Miscellaneous Office Expenses		74 12 9	
3,459				3,825 2 7
	Journal of the Society, Vol. 78 —			
840	Printing and Binding		672 3 9	
245	Postage, Packing, and Delivery		245 0 0	
225	Editing and Literary Contributions		225 0 0	
50	Illustrations		60 0 0	
1 360		£ s d	1 202 3 9	
55	*Less* Sales (Vol 77 and earlier)	47 3 9		
225	Advertisements (Vol 78)	275 0 0		
280			322 3 9	
1 080				880 0 0
120	Excess expenditure in production of Vol 77			23 4 0
33	*Printing Pamphlets*			
	Laboratory :—			
711	Salary and Petty Cash			709 17 9
	Other Scientific Departments —			
250	Botanist's Salary		250 0 0	
200	Zoologist's Salary and Expenses		203 10 0	
53	Consulting Engineer		52 19 9	
400	Grant to Royal Veterinary College		400 0 0	
—	Grant to Research Institute University College Reading		100 0 0	
2	Medals for Proficiency in Cattle Pathology		2 10 4	
905				1,009 0 1
	National Diploma in Agriculture			
130	Honoraria and Expenses of Examiners		142 9 7	
45	Travelling Expenses of Officials		32 9 10	
29	Hotel Expenses of Examiners and Officials		30 7 10	
28	Printing Stationery, and Postage		57 18 6	
2	Writing Diplomas		1 18 0	
75	Salaries for Assistants		74 10 0	
309			339 11 9	
87	*Less* Entry Fees and Sales of Examination Papers		56 18 0	
222			282 13 9	
111	*Less* Highland and Agricultural Society's Moiety		141 6 10	
111				141 6 11
	National Diploma in Dairying :—			
11	Hire of Premises &c		19 15 7	
42	Fees to Examiners		61 9 0	
21	Hotel and Travelling Expenses		26 5 4	
8	Printing and Postage		15 5 0	
—			122 14 11	
82	*Less* Entry Fees and Sales of Examination Papers		26 5 0	
41				96 9 11
41	**Extra Expenditure —**			
	War Emergency Committee		207 14 4	
	Contribution towards Woburn Farm		150 0 0	
	Hills' Bequest —Contribution for current year		106 8 2	
	Occasional Notes to Members		142 3 5	
	Assistance in Library		57 17 6	
	Contribution to Board of Scientific Societies		10 0 0	
207				674 3 5
2,500	**AMOUNT SET ASIDE TOWARDS LOSS ON SHOWS**			2,500 0 0
851	**CREDIT BALANCE CARRIED TO BALANCE SHEET**			818 12 6
£10,018				£10,677 17 2

Examined, audited, and found correct, this 19th day of February 1918

JONAS M. WEBB,
H J GREENWOOD, } *Auditors on behalf of the Society*

[Copies of the full Report of any of the Council Meetings held during the year 1917 may be obtained on application to the Secretary, at 16 Bedford Square, London, W.C.1.]

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

Minutes of the Council.

WEDNESDAY, JANUARY 24, 1917.

Mr C ADEANE (President) in the Chair

Present:—*Trustees* - The Earl of Coventry Sir Gilbert Greenall, Bart, C V.O, the Earl of Northbrook, the Hon. C T Parker

Vice-Presidents—The Right Hon Sir A. E Fellowes, K C V O, Mr Ernest Mathews, the Earl of Yarborough

Other Members of the Council - Mr W W Chapman, Mr John Evens, Mr James Falconer, Sir Walter Gilbey, Bart, Lord Harlech, Mr Robert W Hobbs, Sir Charles V. Knightley, Bart, Mr J L Luddington, Mr Alfred Mansell, Mr G Norris Midwood, Capt R Oliver-Bellasis, Mr H Overman, Mr R G Patterson, Mr F Hamlyn Price, Mr John Rowell Mr Fred Smith, Mr C W Tindall, Col E V V Wheeler, Capt J Bell White, R N R, and the Right Hon Frederick Wrench

The minutes of the last monthly meeting of the Council, held on December 6, 1916, were taken as read and approved

Mr D P Mingos, of Ezbet-el-Nakhale, Cairo, Egypt, and Capt J Bell White, R N R, of Alderbourne Manor, Gerrard's Cross Bucks were elected as Governors, and 50 duly nominated candidates were admitted into the Society as Members

The Report of the Veterinary Committee having been presented, Mr MANSELL drew attention to the increase in the number of cases of sheep scab in 1916, as compared with those in 1915, and moved the following resolution, which was seconded by the Rt Hon FREDK WRENCH and adopted —

> 'That this Council view with alarm the increase in the number of outbreaks of sheep scab in 1916 as compared with 1915, and trust that the Board of Agriculture will take energetic steps to deal with the question'

The PRESIDENT, in moving the adoption of the Report of the War Emergency Committee, explained very fully what had transpired on each of the three occasions on which the Committee had met

A considerable discussion ensued on the question of the depletion of farm labour and the policy of maximum prices, and it was finally decided to ask the War Emergency Committee, who would meet that afternoon, to draw up two resolutions and adopt them in the name of the Council. This was done at the subsequent meeting of the Committee, and the following resolutions were forwarded to the Board of Agriculture

> (1) 'That the Council, recognising that even the maintenance of the food production of this country is absolutely dependent upon the provision of an adequate supply of skilled labour—viz, horsemen, stockmen, shepherds and farm machinists view with alarm the continued removal of farm labour from the land by the War Office, and urge the Board of Agriculture to do all in their power to prevent the labour of the farm from being further depleted"
>
> (2) 'That this Council are of opinion that the fixing of maximum prices for cereals is a fatal policy because it is certain to diminish the production of food in the country They are also of opinion that a guaranteed minimum should be offered for all cereals for a period of at least four years, and that four years' notice shall be thereafter given before withdrawal This would give confidence to agriculturists'

The Earl of NORTHBROOK reported that a cable had been received from Dr Levinge, of New Zealand, suggesting that the Royal Agricultural Society should issue an urgent appeal for funds for the Agricultural Relief of Allies through the Press associations to all Colonial Agricultural Societies. Dr Levinge was of opinion that such a step would have a great stimulative effect on the local movements for the repatriation of the Allied farmers, and it was the desire of the Committee to act upon that suggestion. He (the Earl of NORTHBROOK) would therefore move:—

> That the President be requested to cable Dr Levinge asking him to communicate to the agricultural societies in New Zealand the following resolution:
>
> That the Council of the Royal Agricultural Society of England desire to express their high appreciation of the kind support already extended by New Zealand to the Fund for reinstating the ruined farmers of the devastated countries of our Allies, and to make an urgent appeal to the agriculturists of New Zealand for additional subscriptions to enable the Committee to meet further demands. Letter follows. ADEANE, President.

The Earl of YARBOROUGH seconded the resolution, which was adopted.

WEDNESDAY, FEBRUARY 21, 1917

Mr C. ADEANE, C.B. (President), in the Chair.

Present: *Trustees*: Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Lord Moreton.

Vice-Presidents: Mr Percy Crutchley, the Right Hon. Sir A. E. Fellowes, K.C.V.O., Mr Ernest Mathews, the Duke of Portland, K.G.

Other Members of the Council: Mr H. Dent Brocklehurst, Mr Richardson Carr, Mr James Falconer, Sir Howard Frank, Sir Walter Gilbey, Bart., Lord Harlech, Mr W. Harrison, Mr Arthur Hiscock, Mr Robert W. Hobbs, Sir Charles Knightley, Bart., Mr J. L. Luddington, Mr Alfred Mansell, Earl Manvers, Mr C. Middleton, Capt. R. Oliver Bellasis, Mr H. Overman, Mr A. W. Perkin, Mr E. Hamlyn Price, Mr E. Reynard, Mr Andrew Rogers, Capt. Percy W. Sewell, Mr Fred Smith, Lieut.-Col. E. W. Stanyforth, Mr B. Hunt, and Capt. J. Bell White, R.N.R.

Governor: Mr W. E. Holt Beever.

The minutes of the last meeting of the Council held on January 24, 1917, were taken as read and approved.

Mr Walter James Alcock, of Ilketshall Hall, Bungay, and Mr Bowater Vernon, of Hanbury Hall, Bromsgrove, were elected Governors, and 25 duly nominated candidates were admitted into the Society as Members.

The Report of the Finance Committee was received and adopted, together with the Accounts for 1916 and Estimates of Receipts and Expenditure for the present year, which were explained in detail by Mr ADEANE, Chairman of the Finance Committee.

The Earl of COVENTRY said that before the Council proceeded further with the business of the Meeting he should like to call their attention to a circumstance which had given them considerable gratification. Their President had received the distinction of having been made a Companion of the Order of the Bath. He was sure they all hoped that he might live long to enjoy the honour thus conferred upon him. As His Majesty's Lieutenant in Cambridgeshire Mr Adeane had rendered very signal service to that county, and they all knew what excellent work he had done in connection with agriculture. (Applause.)

The PRESIDENT thanked the Members of the Council very heartily for their kindness in receiving so warmly the generous remarks which had been made regarding himself by Lord Coventry. He could assure them that he appreciated their congratulations very much indeed.

In presenting the Report of the Veterinary Committee, the following letter was read from the Board of Agriculture in regard to the increase in the number of outbreaks of sheep scab in 1916:—

Board of Agriculture and Fisheries,
Whitehall Place, London, S.W.
February 14, 1917

No. A 676/1917

SIR, I am directed by the President of the Board of Agriculture and Fisheries to refer to your letter of the 25th ult., forwarding a copy of a resolution passed by the Council of the Royal Agricultural Society of England relative to the increase in the number of outbreaks of sheep scab recorded in Great Britain during 1916 as compared with the previous year, and I am to acquaint you, for the information of the Society, that this matter has been receiving the careful attention of the Board.

The increase in the number of outbreaks of this disease is accounted for to a large extent by the number of small outbreaks which have occurred in Scotland, and in the majority of these the number of sheep involved was very small. A number of the outbreaks are also attributable to sheep moved from the western islands of Scotland, especially the Outer Hebrides, and also from portions of the mainland of Argyllshire.

In addition to the measures provided by the Sheep Scab Orders of 1905 and 1910, which are enforced as a matter of course as regards the isolation and dipping of sheep on infected premises, and of sheep which are known or suspected to have been in contact with the affected sheep the Board have made special Orders, applying the provisions of Part I of the Sheep (Double Dipping) Order of 1914 to the movement of sheep from the Inner and Outer Hebrides, and also from certain areas in the islands and on the mainland of Argyllshire, to any other part of Great Britain. The effect of the last mentioned restrictions is to require that all sheep so moved must be accompanied by a licence of an inspector of the local authority authorising the movement, which, unless the sheep are intended for immediate slaughter, may only be granted in the case of sheep which the inspector is satisfied have been properly dipped twice within the previous twenty eight days.

Similar restrictions have been imposed by an Order of the Board on the movement of sheep from an area in the Ochil Hills comprising portions of the counties of Perth, Clackmannan, Stirling and Kinross, in which a number of outbreaks have occurred, and from which sheep subsequently found to be affected have been moved.

Copies of the above mentioned Orders are enclosed.

Mr. Prothero hopes that the enforcement of these restriction may result in preventing the distribution of sheep scab by means of sheep from the western parts of Scotland, which, there is strong reason to believe have been responsible for carrying the disease for some years past to other parts of Scotland and to England; but, if the measures now taken are found to be insufficient for this purpose, he will not hesitate to adopt such other means to this end as may be considered necessary and expedient.

I am, Sir, your obedient servant,
(Signed) SYDNEY OLIVIER, Secretary.

The Secretary, Royal Agricultural Society of England.

Mr **MANSELL** reported that the National Sheep Breeders' Association were arranging for a deputation to wait on Mr Forster, Financial Secretary to the War Office, to discuss with him the price of the 1917 Wool Clip. Mr Mansell proposed that the Royal Agricultural Society should be represented on the deputation, and suggested the names of Mr. Davis Brown and Mr Robert W Hobbs. The proposition was carried.

WEDNESDAY, MARCH 28, 1917.

MR. C. ADEANE, C B (President), in the Chair

Present:—*Trustees.*—Sir J. B. Bowen-Jones, Bart, the Earl of Coventry

Vice-Presidents.—Mr Percy Crutchley, Mr Ernest Mathews, the Duke of Portland, K.G.

Other Members of the Council.—Mr. D T Alexander, Mr H. Dent Brocklehurst, Mr. Richardson Carr, Mr. W. W Chapman, Mr John Evens, Sir Howard Frank, Sir Walter Gilbey, Bart., Mr. Arthur Hiscock, Mr. Robert W. Hobbs, Mr. J L. Luddington, Mr. Alfred Mansell, Earl Manvers, Mr. C. Middleton, Mr. John Myatt, Capt R. Oliver-Bellasis, Mr. H. Overman, Mr.

R. G. Patterson, Mr. A. W. Perkin, Mr. H F Plumptre, Mr F. Hamlyn Price, Mr. F. Reynard, Mr. C Coltman Rogers, Mr John Rowell, Capt. Percy W. Seward, Lieut -Col E. W Stanyforth, Lord Strachie, Sir John O. S. Thursby, Bart, Mr C W Tindall, and Col. Wheeler.

The minutes of the last meeting of the Council held on February 21, 1917, were taken as read and approved.

The **President** said that since the last meeting of the Council the Royal Family had sustained a sad bereavement by the death of Her Royal Highness the Duchess of Connaught He was sure that, having regard to the great interest which the Royal Family had ever shown in the welfare of the Society, and of agriculture generally, the Council would desire to place on record their deep sense of sorrow at the death of the Duchess of Connaught, and to express their respectful sympathy to the Duke of Connaught

Mr Edward Clifton-Brown, of Burnham Grove, Burnham, Mr G. R. C. Foster, of Anstey Hall, Trumpington, Cambridge, Mr S Arthur Peto, of Downs Court, Sandwich, Kent, and Mr. Wm. D Thompson, of Dyke House, West Hartlepool, were elected Governors, and 56 duly nominated candidates were admitted into the Society as Members

A letter was read from the Machinery and Implements Section of the Board of Agriculture respecting the holding of a demonstrating exhibition of motor tractors under the auspices of the Society.

The **President** said the matter had been before the War Emergency Committee, and they had agreed to recommend the Council to refer the letter to the Special Committee appointed some time ago, consisting of the Honorary Director, the Chairman of the Implement Committee, and the two Stewards of Implements, with power to add to their number

WEDNESDAY, APRIL 25, 1917.

Mr C Adeane, C B (President), in the Chair

Present *Trustees* H R H Prince Christian, K.G, Lord Moreton the Earl of Northbrook, Sir John H Thorold, Bart

Vice-Presidents Mr. Ernest Mathews, the Earl of Yarborough

Other Members of the Council —Mr. J T. C Eadie, Mr James Falconer, Sir Howard Frank, Sir Walter Gilbey, Bart, Lord Harlech, Mr W Harrison, Sir C V Knightley, Bart, Mr J L Luddington, Mr Alfred Mansell, Earl Manvers, Mr John Myatt, Capt R Oliver-Bellasis, Mr. H. F Plumptre, Mr F. Hamlyn Price, Lord Ranksborough, C V O, C B, Mr J E Rawlence, Mr. F. Reynard, Capt Percy W Seward, Mr Fred Smith, Lt -Col. E. W Stanyforth, Lord Strachie, Capt J Bell White, R N.R, Col. C W Wilson, and the Rt Hon. Frederick Wrench

The Minutes of the last Meeting of the Council, held on March 28, 1917, were taken as read and approved.

The **President** read the following letter of acknowledgment of the resolution of sympathy with H R H the Duke of Connaught, passed at the last meeting ·

> **Dear Sir,**—I am desired by H R H the Duke of Connaught to thank you and to ask you to convey to the Council of the Royal Agricultural Society His Royal Highness sincere thanks for the kind expression of sympathy as contained in your letter of March 28 —Believe me, yours faithfully,
>
> (Signed) **Malcolm Murray**, Lieut -Col.

Mr. Herbert Allott, J.P, of Ivy Cottage, Hoyland Common, Barnsley, the Hon George Eden, of Redcroft, Longcross, Chertsey, Mr Charles Wm. Forbes, of Callendar House, Falkirk, Mr Fred H Fox, of Inglewood, Ledsham, near Chester, Comr Herbert L Gaussen, R.N V R. of Brookmans Park, Hatfield, Lord Lilford, of Lilford Hall, Oundle, Mr. R W. Lund, of

Huttons Ambo Hall, York, and Viscount Peel, of 52, Grosvenor Street, W, were elected Governors, and 73 duly nominated candidates were admitted into the Society as Members

In moving the adoption of the report of the Finance Committee, Mr Adeane said that the Council would be sorry to learn that Mr Everson, a member of the staff had been wounded Fortunately his wound was not a severe one, and it was understood that he was now going on very well He (Mr Adeane) would move that having heard with regret that Mr Everson had been wounded in France, the Council desire to express their sympathy with him, and their hopes for his speedy recovery

This was unanimously agreed to

The **President** said the Council would remember that at their last Meeting a letter was read from the Machinery and Implements Section of the Board of Agriculture respecting the holding of a demonstrating exhibition of motor tractors under the auspices of the Society and the matter was referred to the Special Committee appointed in November to carry out the demonstration

The Government had received an offer from Mr Ford, of America to place at their disposal the plans and specifications of his agricultural tractor as well as the services of his experts in order that these machines might be made in this country by British manufacturers provided they were not sold but only used by the Government Before accepting the offer, Sir Arthur Lee was anxious to obtain the advice of the Royal Agricultural Society In this emergency he (the President) thought that the Society would be anxious to assist, and stated that he would bring the matter before the Council at that Meeting, but Sir Arthur Lee said that immediate action was necessary, as he must come to a decision at once It was therefore arranged that the two Ford tractors now in this country should be tried and that a jury of practical agriculturists and engineers should inspect the working of the machines and report

The Judges selected were Professor Dalby, F R S, of the City and Guilds Engineering Institute South Kensington Mr Courtney, the Society's Consulting Engineer, Mr Greaves Chairman of the Implement Committee representing both Engineering and Practical Agriculture Mr R W Hobbs and Mr Henry Overman, Practical Agriculturists The expenses of the Demonstration would be defrayed by the Government The necessary land for the Trials had been provided by Sir Gilbert Greenall who was entertaining the Judges at his house, and was being assisted by the Hon John E Cross in carrying out the arrangements

The **President** asked the Council to approve of these arrangements and to give him power to submit at the earliest possible moment the Report of the Judges to Sir Arthur Lee, at the Board of Agriculture He moved a resolution to that effect, which was seconded by Mr Harrison and adopted by the Council

WEDNESDAY, MAY 30, 1917.

Mr C **Adeane**, C B (President), in the Chair

Present:—*Trustees* Col Cornwallis, the Earl of Coventry, Sir Gilbert Greenall, Bart, C V O, Lord Moreton, the Earl of Northbrook, Sir John H Thorold, Bart

Vice-Presidents Mr Percy Crutchley, Mr R M Greaves, Mr Ernest Mathews, the Earl of Yarborough

Other Members of the Council -Mr H Dent Brocklehurst, Mr W W Chapman the Hon J E Cross, Mr J T C Eadie, Mr John Evens, Mr James Falconer, Sir Howard Frank, Sir Walter Gilbey, Bart Mr Arthur Hiscock Mr R W. Hobbs Sir C V Knightley Bart Mr Alfred Mansell, Earl Manvers Capt R Oliver Bellasis Mr A W Perkin Mr I Hamlyn

Price, Lord Ranksborough, C.V.O., C.B., Mr. J. Reynard, Mr. Andrew Rogers, Lieut.-Col. E. W. Stanyforth, Lord Strachie, Mr. A. P. Turner and Capt. J. Bell White, R.N.R.

Governors: Mr. W. T. Holt Beever and Mr. C. T. Evans.

The Minutes of the last Meeting of the Council held on April 25, 1917, were taken as read and approved.

The PRESIDENT said that Members of Council would have learnt with feelings of great regret that since their last meeting their esteemed friend and colleague Sir Ailwyn Fellowes had suffered a very sad bereavement by the death in action of his third son Captain Hedworth George Ailwyn Fellowes.

He was sure that the Council would desire to convey the expression of their warm and sincere sympathy with Sir Ailwyn and Lady Fellowes and he therefore moved the following resolution of condolence with them in their great sorrow:

> That the Council of the Royal Agricultural Society of England have heard with feelings of great regret of the death in action of Captain Hedworth George Ailwyn Fellowes, the third son of Sir Ailwyn Fellowes, and desire to convey the expression of their warm and sincere sympathy with Sir Ailwyn and Lady Fellowes in the great sorrow which has befallen them.

The resolution was seconded by the Earl of YARBOROUGH, and carried unanimously, all the Members present standing.

The Earl of Egmont, of Avon Castle, Ringwood; Mr. Frederick C. Hunter, of Bystock, Exmouth; Mr. George Lawson Johnston, of The Cottage, Bletsoe, near Bedford; Sir Arthur Lee, K.C.B., M.P., of Chequers Court, Princes Risborough; Right Hon. Sir Alfred Mond, Bart., M.P., of Melchet Court, near Romsey; Mr. Frederick S. Oliver, of Checkendon Court, Oxon; Mr. Sidney Vernon Price, of The Cottage, Costessey; Mr. William M. Saunders, of Wennington Hall, Lancaster; and Mr. H. C. B. Underdown, of Buckenham Tofts, Mundford, were elected Governors and 117 duly nominated candidates were admitted into the Society as Members.

The Earl of NORTHBROOK, in presenting the Report of the Veterinary Committee, said that the Committee were strongly of opinion that the increase in the number of cases of sheep scab calls for the serious consideration of the Government. The hope expressed in a letter from the Board of Agriculture that the enforcement of the restrictions might result in preventing the distribution of the disease not having been realised, it is time to adopt other measures as suggested by the Board, and moved that this should be communicated to them.

Mr. MANSELL seconded the proposition, and the Report was adopted.

In presenting the Report of the Stock Prizes Committee, Mr. REYNARD said that the Committee had considered a resolution passed by the London Cart Horse Parade Society with regard to the scarcity of horses, and the Committee had recommended the Council to adopt the following resolution, copies of which should be forwarded to the Prime Minister, the President of the Board of Agriculture and the Secretary of State for War:

> That in view of the recognised shortage of horses and the certainty under existing circumstances of a further decline in horse breeding, this Society views with the greatest alarm the future prospects of horse breeding in the United Kingdom and strongly urge upon the Government the importance of taking immediate steps for the encouragement of horse breeding generally.

Sir JOHN THOROLD, in moving the adoption of the Report of the Committee of Selection, said that the Council would heartily thank the President for the efforts he had made and continued to make in obtaining new Governors and Members.

The PRESIDENT said that, while acknowledging the thanks offered by Sir John Thorold, he should like to pass them on to Mr. McRow and his staff, upon whom the work fell, and he would congratulate them on the result.

The Report of the War Emergency Committee was adopted after a lengthy discussion, in which Mr. EVENS, Lord STRACHIE, Sir WALTER

GILBEY, the Earl of **COVENTRY**, Mr. **FALCONER**, Mr **MANSELL**, Mr **BROCKLEHURST**, the Earl of **NORTHBROOK** and the Hon **JOHN E. CROSS** took part.

The Report on the recent Trial of the Ford Tractor was presented, together with the following letter which had been received from the Director General of the Food Production Department:

[COPY.]

Board of Agriculture and Fisheries,
Food Production Department,
72 Victoria Street,
London, S.W.1.
May 3, 1917.

DEAR MR MCROW,—I shall be much obliged if you will express to the Royal Agricultural Society my sincere and grateful thanks for the extremely valuable and satisfactory report which they have furnished to this Department on the merits of the Ford Tractor for agricultural purposes. I recognise that it was asking a good deal of the Society to organise and carry out this trial at such short notice, but the result has been most helpful and indeed invaluable to me.

Will you kindly convey my special thanks to the distinguished panel of Judges who kindly undertook this work?

Yours very truly,
(Signed) ARTHUR LEE.

WEDNESDAY, JUNE 27, 1917.

Mr C. **ADEANE**, C.B. (President) in the Chair.

Present:—*Trustees.* Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Lord Moreton, the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr Percy Crutchley, Mr Ernest Mathews, the Duke of Portland, K.G., the Duke of Richmond and Gordon, K.G.

Other Members of the Council.—Mr Richardson Carr, Mr W. W. Chapman, Mr John Evens, Mr James Falconer, Sir Howard Frank, Sir Walter Gilbey, Bart., Mr Joseph Harris, Mr W. Harrison, Mr Alfred Mansell, Earl Manvers, Mr C. Middleton, Mr G. Norris Midwood, Mr H. Overman, Mr R. G. Patterson, Mr F. Hamlyn Price, Mr F. Reynard, Capt. Percy W. Seward, Mr Fred Smith, Sir John O. S. Thursby, Bart., and the Right Hon. Frederick Wrench.

Governor.—Mr W. F. Holt Beever.

The minutes of the last meeting of the Council held on May 30, 1917, were taken as read and approved.

Before commencing the proceedings the **PRESIDENT** read a letter from the Right Hon. Sir Ailwyn E. Fellowes, K.C.V.O., thanking the Council for their kind expressions of sympathy on the death, in action, of his son Captain Hedworth George Ailwyn Fellowes.

Mr H. W. Anderson, of Hermitage Farm, High Hurstwood, Uckfield, Mr Albert S. B. Hull, of Crookham House, Newbury, Sir G. Stanley White, Bart., of Holywood Tower, Bristol, and Mr W. H. Williamson, of Kirkbank, Middleton Tyas, were elected Governors, and 94 duly nominated candidates were admitted into the Society as Members.

The Report of the War Emergency Committee was adopted after discussion in which Mr **MIDDLETON**, Mr **FRED SMITH**, Sir **WALTER GILBEY**, Mr **HARRISON**, Sir **GILBERT GREENALL**, the Right Hon **FREDERICK WRENCH**, Mr **FALCONER**, Mr **MANSELL**, Sir **JOHN THOROLD**, and the Earl of **NORTHBROOK** took part.

A communication was read from the Shorthorn Society enclosing copy of the following resolution:

> **"That the Shorthorn Society hereby request the Royal Agricultural Society of England to arrange for a deputation consisting of representatives of the R.A.S.E. and all the Breed Societies, to wait upon the President of the Board of Agriculture at the earliest possible moment to explain to him the very great value of the Pedigree Studs, Flocks and Herds of this country, and the serious danger in which they are placed by the scheme for the indiscriminate ploughing up of permanent pastures, and to urge that the scheme be modified."**

On the suggestion of the **PRESIDENT** it was agreed that the War Emergency Committee should be asked to give the letter and the resolution their careful consideration

The **PRESIDENT** read a letter he had received from the Académie d'Agriculture de France, of which the following is a translation —

> Academy of Agriculture of France,
> 18 Rue de Bellechasse, Paris.
> June 20, 1917
>
> SIR The French Academy of Agriculture was informed at its meeting on June 13 as you will see by the enclosed Extract of the Proceedings, of the magnificent efforts made by the British Army for the restoration of the land in the region conquered by their valour The Academy has been deeply touched by the devotion shown in these circumstances by your officers and soldiers They believe that the best way of showing the gratitude of the French agriculturists is by sending you evidence of this and begging you to acquaint your great Society with our feelings on the matter
>
> The Academy of Agriculture does not forget that the Royal Agricultural Society of England at the commencement of the war, started the fund for the Agricultural Relief of the Allies and that they opened a subscription list which has been of the greatest utility for the agriculturists who fell victims to the German invasion The Academy is happy at the present time to remember the services rendered by you
>
> Yours &c
> (Signed) JULES DEVELLE President.
> HENRY SAGNIER Permanent Secretary

WEDNESDAY, JULY 25, 1917.

Mr C ADEANE, C B (President), in the Chair

Present *Trustees* The Earl of Coventry, Sir Gilbert Greenall, Bart, C V O, Lord Moreton the Earl of Northbrook, Sir John H Thorold, Bart

Vice Presidents—Mr Percy Crutchley, Mr. Ernest Mathews

Other Members of the Council Mr T L Aveling, Mr H Dent Brocklehurst, Mr W W Chapman the Hon J E Cross, Mr James Falconer, Mr W Harrison, Mr Arthur Hiscock, Mr R W Hobbs, Mr W F Ingram, Sir Charles V Knightley Bart Mr J L Luddington, Mr Alfred Mansell, Mr J Myatt Capt R Oliver Bellasis, Mr H Overman Mr H F Plumptre, Mr F Hamlyn Price Mr I Reynard, Mr C C Rogers, Mr Fred Smith, Lieut Col E W Stanyforth, Lord Strachie, and Mr. C W Tindall

Governors—Mr W F Holt Beever and Mr C L Evans

The minutes of the last meeting of the Council held on June 27, 1917, were taken as read and approved

Mr Albert Flint of Redericks, Harlow, Mr R H Foa of Holywell Park, Wrotham, Mr Richard Fort, of King's Standing, Burton on Trent, Mr R S Gardiner, of Hardres Court Canterbury, Mr Alfred J Gay, of Dummer Down, Basingstoke, and Captain J Harrison-Broadley, of Welton House, Brough, were elected Governors, and 194 duly nominated candidates were admitted into the Society as Members

The Report of the Finance Committee was received and adopted, together with the recommendation that the sum of 650*l* should be transferred from the reserve account to the ordinary account, for the reason that although the Cardiff Show had not been held expenses had been incurred amounting to 4,483*l* Against that there was the contribution from the ordinary account of 2,500*l*, leaving an adverse balance of 1,983*l* This liability would be met by transferring the sum mentioned and by using the estimated balance on the ordinary account which would probably be 1,227*l*

The Report of the Chemical and Woburn Committee was received and adopted The Farm Committee had visited Woburn, and reported that the suggestions of the Board of Agriculture—to devote as much land as possible to the production of corn crops and to the growing of the largest crops possible on the land, at the same time only retaining under experiment such land as formed part of the regular and continuous series of experiments—had been fully complied with.

The Report of the Botanical and Zoological Committee was received and adopted. With regard to the attack in Worcestershire of a boring insect on plum trees, the Committee had considered this a very important matter, and had recommended that the Zoologist be instructed to visit the place and advise as to the means to be taken to eradicate the pest.

The Report of the Veterinary Committee was received and adopted. The Earl of NORTHBROOK, in moving the adoption of the Report, said the Committee regarded with grave alarm the ill success of the restrictive measures which the Board of Agriculture said had been put into force, and which were expected by the Board to lead to a material reduction in the number of outbreaks of sheep scab. In point of fact there had been a continued increase in the number of cases which were now 118 per cent more than those reported up to the same date last year. With the approval of the Council the Committee proposed to point out these facts to the Board and to state that if the disease was to be successfully controlled no time should be lost in dealing with it drastically as the difficulties now were less than in the later period of the year. If future returns did not indicate an appreciable decrease in the number of outbreaks the Committee proposed to ask the Board of Agriculture to receive a deputation from the Society.

The Report of the Committee of Selection was received and adopted, together with the recommendation that in view of the large numbers of new Members still coming in a small Committee consisting of the President, the Hon Director and Mr Ernest Mathews, be empowered to meet once a month during the recess to elect those candidates whose forms of nomination have been received by the Secretary and that Members elected after July 25 be entitled after payment of their first subscription, to the privileges of membership without further payment until the end of 1918.

The Report of the War Emergency Committee was adopted after discussion, in which Mr SMITH the Earl of COVENTRY Mr BROCKLEHURST, Mr MANSELL Mr HISCOCK Mr CHAPMAN Lord STRACHIE, Mr OVERMAN and Mr FALCONER took part.

WEDNESDAY, NOVEMBER 7, 1917.

Mr C ADEANE C B (President in the Chair

Present *Trustees* —Colonel Cornwallis the Earl of Coventry Sir Gilbert Greenall, Bart, C V O the Hon C T Parker, Sir John H Thorold Bart

Vice-Presidents —Mr Percy Crutchley the Rt Hon Sir A E Fellowes, K C V O, Mr Ernest Mathews, the Duke of Portland K G

Other Members of the Council —Mr D T Alexander Mr T L Aveling, Mr Davis Brown, Mr T A Buttar, Mr Richardson Carr, the Hon J E Cross, Mr. James Falconer, Sir Howard Frank Mr W Harrison, Mr R W Hobbs, Mr John Howard Howard, Capt Dunbar Kelly Major G R Lane Fox M P, Mr J L Luddington, Mr Alfred Mansell, Mr C Middleton Mr G Norris Midwood, Mr W A Mount, M P Mr J Myatt, Capt R Oliver-Bellasis, Mr H F Plumptre, Mr F Hamlyn Price, Mr G G Rea, Mr F Reynard, Mr. C C Rogers, Mr John Rowell, Capt Percy W Seward, Mr Fred Smith Lieut-Col E W Stanyforth, Lord Strachie, Mr A P Turner, and Capt J Bell White, R N R

Governors —Capt Sir Beville Stanier, Bart, M P and Mr K J J Mackenzie

At the commencement of the proceedings the PRESIDENT said, "I rise at the earliest opportunity to formally report to the Council the death of His Royal Highness Prince Christian at whose funeral at Windsor I attended as representative of the Society on Thursday last. Prince Christian had for many years been a great friend and supporter of the Society, becoming a Governor in 1874, and as a Vice-President and a Trustee he rendered great service. The term of H.R.H.'s Presidency in 1902 will be remembered by many, as during that year the last of the migratory shows, before going to Park Royal, was held at Carlisle. Prince Christian took a practical interest in agricultural matters, and his frequent attendances at the meetings of the Council were highly appreciated. I am sure it would be the desire of the Council to place on record our deep sense of sorrow at the death of Prince Christian, and to convey the expression of our respectful sympathy to H.R.H. Princess Christian.

"I beg to move the following resolution:—

> "'We, the President and Council, representing the general body of Governors and Members of the Royal Agricultural Society of England desire to express to your Royal Highness our deep sorrow at the bereavement you have sustained by the death of H.R.H. Prince Christian.
>
> "The Royal Agricultural Society have received so many marks of his Royal Highness's favour and interest in its work, as a Member of the Council and as President of the Society, that the Members feel his death as a personal loss, and they desire to approach your Royal Highness with the assurance of their respectful sympathy in your great sorrow.'"

The Earl of COVENTRY seconded the resolution, and said the Council would feel the deepest sympathy with Her Royal Highness in her bereavement, and they greatly regretted that they would not again have Prince Christian among them. His Royal Highness took the very greatest interest in the affairs of the Society, and was always anxious to promote the welfare of agriculture. He was also a great friend of hunting, racing and cricket, and, in short, fulfilled all the best attributes of a country gentleman. (Hear, hear.) They were all the poorer by his loss.

The minutes of the last meeting of the Council, held on July 25, 1917, were taken as read and approved.

Mr. E. C. Fairweather, of Avisford Park, Arundel, Major W. Francis, of the Mill House, Quy, Cambridge, Mr. A. F. W. Garrod, of Edgar Farm, Great Walsingham, Mr. Neville G. Gwynne, of Bevenden, Oxshott, Mr. C. D. Morton, of Tadworth Court, Surrey, Mr. B. Oppenheimer, of Sefton Park, Stoke Poges, Mr. J. E. Pepper, of Jermyns, Romsey, Mr. F. B. Pitcher, of The Chase, Burnham-on-Crouch, Mr. E. A. Wigan, of Conholt Park, Andover, and Mr. F. A. B. Wood, of Crown Crescent, Scarborough, were elected as Governors, and 191 duly nominated candidates were admitted into the Society as Members.

The PRESIDENT, in presenting the Report of the Finance Committee, said the Committee had approved the application from the Journal Committee for the printing of a catalogue of the books in the Library, the rearrangement of which had been completed. It was found that some of the books were very valuable, and it had been decided to insure them for 3,000*l*. The report was received and adopted.

The Report of the Veterinary Committee was received and adopted, together with the following resolution:

> 'That the Board of Agriculture be asked to give an assurance that no proposal shall be brought forward for the repeal of the Diseases of Animals Act of 1896 until the Royal Agricultural Society and the Breed Societies interested have been consulted.'

On presenting the Report of the Committee of Selection, Sir JOHN THOROLD formally moved:—

> "That the name of the Hon. Cecil T. Parker be recommended to the General Meeting for election as President for the ensuing year."

He said that the Council knew of Mr. Parker's great ability, and that he would do everything to promote the interests of the Society.

Sir GILBERT GREENALL seconded the motion, which was unanimously adopted.

WEDNESDAY, DECEMBER 5, 1917.

Mr C. **Adeane**, C B. (President), in the Chair

Present:—*Trustees.*—Sir J. B Bowen-Jones, Bart, the Earl of Coventry, Lord Moreton, the Earl of Northbrook, the Hon C. T Parker, Sir John H. Thorold, Bart

Vice-Presidents.—Mr Percy Crutchley, the Right Hon Sir A. E. Fellowes, K C V O, Mr Ernest Mathews

Other Members of the Council—Mr D T Alexander, Mr. T L Aveling, Mr Davis Brown, Mr T A. Buttar, Mr. Richardson Carr, Mr W W Chapman, the Hon J E Cross, Col Edward Curre, Mr. J T C. Eadie, Mr John Evens, Mr James Falconer, Sir Walter Gilbey, Bart, Lord Harlech, Mr Arthur Hiscock, Mr R W Hobbs, Mr. John Howard Howard, Sir Charles V Knightley, Bart, Mr J L Luddington, Mr. Alfred Mansell, Earl Manvers, Mr G Norris Midwood Mr John Myatt, Capt R Oliver-Bellasis, Mr F Hamlyn Price, Lord Ranksborough, C V O, C B, Mr F Reynard, Mr Andrew Rogers, Mr C C Rogers, Capt Percy W Seward, Mr Fred Smith, Lieut-Col E W. Stanyforth Lord Strachie, Mr C W Tindall, Mr. A P Turner, and Col E V V. Wheeler

Governor—Mr W F Holt Beever

The **President** said that in reply to the vote of condolence which the Council had passed with H R H. Princess Christian, the following letter had been received —

78, Pall Mall S W 1
November 12 1917

Dear Mr Adeane

I am desired by Her Royal Highness Princess Christian to acknowledge the receipt of your letter of 8th inst, conveying a resolution of sympathy passed by the Council of the Royal Agricultural Society of England on the death of His late Royal Highness Prince Christian I am further desired to add that Her Royal Highness hopes you will be good enough to convey to the Council the Princess's profound appreciation at the earliest convenient opportunity

Yours very truly
Hugo Erskine Wemyss
Equerry in Waiting

The minutes of the last monthly meeting of the Council, held on November 7, 1917, were taken as read and approved

Mr James B Crichton of Luthrie, Cupar, Fife, Mr H A Harmsworth, of Freshwater Grove, Shipley, Sussex, and Mr E Stainton, of Barham Court Canterbury, were elected as Governors, and 91 duly nominated candidates were admitted into the Society as Members

The **President**, in presenting the Report of the Finance Committee, said that although there had been no Show, considerable expenditure had been incurred and there was a debit balance of 4,635*l* Against that was placed the 2,500*l* set aside from the ordinary account against loss on Shows, and there was a sufficient balance on the ordinary account and on the uninvested part of the reserve fund to meet the difference

The Report of the Botanical and Zoological Committee was received and adopted together with the following resolution to be forwarded to the Board of Agriculture and Fisheries —

> 'That in the opinion of the Council it is unfortunate that the Irish methods of testing grass-seeds should have been adopted in this country in place of the almost universally used Continental method '

The Earl of **Northbrook**, in presenting the Report of the Veterinary Committee, said that he, together with Mr Davis Brown, Mr Alfred Mansell, and Mr Ernest Mathews, had waited upon the Minister of Agriculture with regard to the outbreaks of sheep scab They placed before Mr Prothero information and suggestions with a view to checking the disease, which the President of the Board promised should receive careful consideration

The following letter had been received from the Board of Agriculture and Fisheries with regard to the resolution passed by the Council at their last meeting

Board of Agriculture and Fisheries,
4 Whitehall Place, London, S W 1,
November 20, 1917.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to your letter of the 9th inst., forwarding a copy of a resolution passed by the Council of the Royal Agricultural Society of England on the subject of the Diseases of Animals Act, 1896, and I am to acquaint you, for the information of your Society that it is not the intention of His Majesty's Government to remove the present restrictions upon the importation of live cattle into the country

In the case of cattle from Canada no legislation will be introduced unless and until the importation of live cattle born and reared in that country is found to be both practicable and consistent with domestic policy after the war and in any case the Board would naturally, before any legislation is proposed, take steps to obtain the views of breed societies upon the subject and to impose whatever measures may be considered necessary to ensure that no appreciable risk of the introduction of disease should be incurred

I am, Sir,
Your obedient servant,
(Signed) A W ANSTRUTHER,
Assistant Secretary

The Secretary, Royal Agricultural Society of England

In presenting the Report of the Committee of Selection, which was received and adopted, Sir **JOHN THOROLD** said he felt sure the Council would agree that there was no one who had done greater service for the Society than Mr. Adeane, and it gave him much pleasure to move that Mr Adeane be elected a Trustee of the Society and also that Mr Reynard, who they all knew had worked well and hard for the Society for many years, be elected a Vice-President.

The Report of the War Emergency Committee was received and adopted after discussion, in which Mr **MANSELL**, Col **WHEELER**, Mr **DAVIS BROWN**, Lord **STRACHIE**, the Earl of **NORTHBROOK** and Mr **ARTHUR HISCOCK** took part

The following Standing Committees were appointed for 1918 —Finance, Journal and Education, Chemical and Woburn, Botanical and Zoological Veterinary, Stock Prizes, Implement, Showyard Works, Selection, Dairy and Produce, and Special The present Members of the various Committees were (with some exceptions) re-appointed to those Committees Mr W A Mount, M P. was added to the Journal and Education Committee, Col E Curre to the Botanical and Zoological Committee, and the Right Hon Sir Ailwyn E Fellowes, Mr T L Aveling, and Mr Richardson Carr to the Committee of Selection

Proceedings at the Annual General Meeting of Governors and Members,

HELD AT 16 BEDFORD SQUARE, LONDON, W C

WEDNESDAY, DECEMBER 5, 1917.

MR C. ADEANE, C.B. (PRESIDENT), IN THE CHAIR

Present:—*Trustees*—Sir J B Bowen-Jones, Bart., Lord Moreton, the Earl of Northbrook, the Hon Cecil T. Parker, Sir John H Thorold, Bart

Vice-Presidents—Mr Percy Crutchley, the Right Hon Sir Ailwyn E Fellowes, K C V O, Mr. Ernest Mathews, Mr. Frederick Reynard

Ordinary Members of the Council.—Mr D. T Alexander, Mr T L Aveling, Mr H Dent Brocklehurst, Mr. Davis Brown, Mr T A Buttar, Mr Richardson Carr, Mr. W W Chapman, the Hon. John E Cross, Col Edward Curre, Mr J T C Eadie, Mr John Evens, Mr. James Falconer, Sir Walter Gilbey, Bart., Lord Harlech, Mr Arthur Hiscock, Mr. R W. Hobbs, Mr J Howard Howard, Sir Charles V Knightley, Bart., Mr J L. Luddington, Mr. Alfred Mansell, Mr. Christopher Middleton, Mr. G. Norris Midwood, Mr W A. Mount, M P., Mr John Myatt, Capt. R Oliver-Bellasis, Mr Henry

Overman, Mr. F. Hamlyn Price, Mr. C. Coltman Rogers, Mr. Fred Smith, Lieut.-Col. E. W. Stanyforth, Mr. C. W. Tindall, Mr. A. P. Turner, and Col. E. V. V. Wheeler.

Governors. Mr. Leonard Brassey, the Rev. C. H. Brocklebank, Mr. Bowater Vernon.

Honorary Member. Professor Sir John McFadyean.

Members.—The Right Hon. Rowland E. Prothero, M.V.O., M.P., the Hon. Edward G. Strutt, Col. Sir Alan Sykes, Bart., M.P., Capt. Sir Charles Bathurst, K.C.B.E., M.P., Sir R. Henry Rew, K.C.B., Messrs. R. S. Balden, Cecil F. Benson, Charles Burrell, J. F. Crewes, H. S. Daine, W. H. Daun, S. F. Edge, F. C. Fendick, W. R. Gantlett, William Gibson, Southby Hewitt, Michael H. Holman, W. A. Hounsom, James H. Ismay, J. D. Johannesen, John Kendrick, Samuel Kidner, Thomas Latham, James Lay, John T. Mills, Joseph H. Mills, J. Herbert Taylor, Tom Thomson, James L. Thorold, J. Timberlake, Sydney G. Unite, J. Odell Vinter, Eldred G. F. Walker, W. H. Weaver, Jonas M. Webb, F. N. Webb, J. W. Whittome, Capt. H. Fitzherbert Wright, M.P., &c., &c.

The PRESIDENT, in opening the proceedings, said: For some years past we have held our Annual General Meeting of Members at the Royal Agricultural Hall, by the courtesy of the Directors of the Hall Company, but owing to the continuance of the war and the conditions which have arisen, the Royal Agricultural Hall is not available and we therefore meet on this occasion in the Society's own house.

For reasons explained at the last Annual General Meeting, it has not been possible to hold a Show this year, but it has been unanimously decided that the next Show of the Society will be held at Cardiff, as soon as possible after the conclusion of the war. The Society is much indebted to the Lord Mayor and the Cardiff Local Executive Committee for the arrangements they have been able to make with the Marquis of Bute who has kindly allowed the site of the Showyard to remain at the Society's disposal until the year 1919.

Notwithstanding the abandonment of the Show the Council has been fully engaged during the past year. It has been necessary to watch the effect of Departmental Orders on the industry of agriculture, and, where necessary, to draw the attention of the authorities to any Orders which, in the opinion of the Council, would, if persisted in, have adversely affected the production of food. On the advice of the War Emergency Committee the Council have passed resolutions in this connection which have not been without their effect.

The Council has been most desirous of supporting in every way the President of the Board of Agriculture, who, he was glad to say, was present to-day. They recognise that he has an intimate knowledge of agricultural requirements and true sympathy with agriculture. (Hear, hear.) They do, however, deplore the sort of dual control which now dominates the position, and which has more than once during the past year seriously threatened production. The Board of Agriculture is responsible for food production, but its efforts may be entirely destroyed by any ill considered action on the part of the Food Controller.

Farmers are now doing their best, from patriotic motives, to carry out the instructions of the Food Production Department with regard to the ploughing up of pasture, but what is to prevent the Food Controller from fixing the price of cereals next year at such a price as will result in their endeavour being a loss to themselves? Perhaps the President of the Board could give some assurance on this point.

Prices control production, and mere cheapness may mean starvation. It has been the business of this Council continually to bring these matters before the Food Controller and they will be very careful to watch, and, if necessary, criticise, any Order issued in the future which is likely to be detrimental to home production, a matter of such vital importance to the nation at the present time.

The rearrangement of the Society's library and the preparation of a complete catalogue has been carried out by an expert librarian, and it is intended to print the catalogue for the use of those Members of the Society who are interested in agricultural literature The library contains many books of great value, and, in some instances works which are very rare, and it is hoped that in future more use will be made of it than has been done in the past

The work of the Society in its different scientific branches veterinary, chemical, botanical, and zoological has been maintained This work, though appreciated in many quarters, is capable of further development, and it would add greatly to the value of these different researches and to the interest felt in them if they were put to practical test by Members of the Society under general farming conditions in different parts of the country A system of co-operation between the Society and its Members throughout the country whereby organised experiments could be carried out, thus bringing practice and science into more intimate relationship, would arouse interest and be of great value

The Society has lost by death a large number of its principal supporters, many of whom have died fighting for their country

It will, however, be noticed that a large number of governors and members have been elected during the year, in fact, only on one previous occasion—during the jubilee year of the Society—has the number of forty-five governors and 1,143 Members been exceeded (Hear hear) Taking into account those who had been elected that morning, there has been an addition to the membership of 1,239 Governors and Members in 1917 Such an accession of strength in a year when there was no show will have a stimulating effect upon all to go on and make the Society more useful to its Members and to agriculture generally He (the President) did not think the Society was ever in a stronger position than it is to-day (Applause)

Capt Sir **CHARLES BATHURST** moved the adoption of the report of the Council, and remarked that in the existence of this the senior of their agricultural organisations, there had never been presented to the Members a more satisfactory record of a year's work, or one that had demonstrated to a greater extent the enormous importance of agriculture and of its wise administration in the highest national interests After referring to the loss the Society had sustained by the death of Prince Christian and of other prominent supporters, Sir Charles went on to say that the increase in the membership by no less than 1,239 was the strongest indication of the usefulness of the Society's work and of the recognition of the value of its assistance to the farming world One most important work which the Society had initiated during the last few years was the effort it had most successfully made to extend some help in kind to those unfortunate brother-agriculturists who, in the devastated countries of our Allies, so sorely needed all the assistance this country was in a position to give It was satisfactory to learn from the report that the Overseas Dominions were coming to our aid in this respect, and they would hope that the people of this country would continue to do their part and not allow even their Colonial cousins to outdo them in that work of fraternal philanthropy Northern Italy had now been overrun by enemy troops, and there again was a fresh field for endeavour on the part of that important Committee, whose work deserved most generous and increasingly generous support

The report of the Council referred to the trial of the Ford Tractor, and he ventured to hope that the estimate of the tractor which had been formed by the judges appointed by the Society would be more than realised In this matter they owed a great debt of gratitude to Sir Gilbert Greenall for placing at the disposal of the Society an area of his estate for the purpose of the experiments

Of the Society's activities none was more profitable than the work done by the War Emergency Committee If he might say so in the presence of the

President of the Board of Agriculture, never had the Board of Agriculture had need to a greater extent than in these critical times of the wise counsel of men of exceptional foresight and agricultural knowledge or, indeed, of the gentle pressure which came as such a useful tonic to Government Departments —(laughter)—in carrying out the Department's most difficult and delicate duties in the face of overwhelming ignorance and short-sightedness. No body of agriculturists had given wiser advice to the Government than the War Emergency Committee, and it was satisfactory to note that in every important particular its advice had been adopted, sometimes somewhat reluctantly, perhaps, but nevertheless adopted and acted upon. As until recently the spokesman of the Ministry of Food in the House of Commons, it was his opinion that but for the work of that Committee and the healthful pressure it exercised the country would to-day be far nearer starvation than actually was the case.

The report referred to the efforts made in the direction of the maintenance of the supply of essential fertilisers and the prohibition of their export. It had seemed to him impossible for a Government to explain why the export of sulphate of ammonia or basic slag should have been permitted at a time when it had never been more greatly wanted. The Committee had drawn attention to the fact that compulsory ploughing up of land must be accompanied by minimum prices for cereals for a period of years. He ventured to hope that in order to afford some measure of security and confidence to farmers the prices under the Corn Production Act might not be allowed to fall into desuetude for many years to come if farmers were to be induced to invest and retain their capital in the land for the good of the country as they ought to do.

The report also gave a caution against the excessive ploughing up of grass land. The President of the Board of Agriculture, he knew, had this matter well in hand, and had made a valuable concession, considering what the original programme was. A question in regard to which the War Emergency Committee had done admirable work was that of fixing the prices of meat, milk, and other farm products. They had urged the importance of giving ample notice before such prices came into operation, and in his own opinion that notice ought to be at least nine months in respect of all the products of English farmland. With reference to milk, the Committee had persuaded the authorities to fix the price at a decent level. In times of serious emergency, and when there was a danger of social unrest, milk came next to bread in order of importance if such unrest and food riots were to be avoided. What appeared to have actuated the policy of that Committee—and he wished to endorse it—was that the availability of food was of infinitely more importance than its low price. (Applause.)

Two matters which he ventured to think were worthy of the consideration of the Committee had occurred to him. One was the great prevalence of the rat pest in this country, which had destroyed a very large amount of corn and needed drastic treatment, and the other was that the Board of Agriculture should be asked to make the spraying of potatoes against disease compulsory during the coming year. He concluded by moving the adoption of the Report, and added that he had never undertaken a task with greater pleasure or more complete confidence. (Applause.)

MR. JOHN KINDRICK, in seconding the motion, urged individual Members to make the position of the Society still stronger by securing as many new Members as possible. He also referred to the prevalence of sheep scab, and said that farmers regretted that the Board of Agriculture had not been able to bring about any serious check in the disease.

MR. S. F. EDGE, speaking with reference to the section of the Report dealing with the trial of the Ford Tractors, said he was afraid that, published in the way it was, the Report of the Judges gave the impression to the public and the officials of the Government that it was the only tractor. The Ford Tractor, he agreed, was a useful and desirable machine, but it was an untried tractor, and had never been manufactured in commercial quantities He urged that it was desirable that, before pledging itself to reports as to the value of such machinery, the Society should when arranging a trial, institute something more in the nature of a comparative test With reference to the suggestion made by Sir Charles Bathurst as to compulsory spraying of potatoes if that question were tackled, facilities should be given to manufacturers to obtain materials for making the sprayers

The Report was then unanimously adopted

Colonel Sir **ALAN SYKES** Bart M P moved 'That the Hon Cecil T Parker be elected President of the Society, to hold office until the next ensuing Annual General Meeting' He said Mr Parker was a very old Member of the Council, having been elected in 1881, was for many years Hon Director of the Society's Shows, and had been previously a steward in several departments His interest in the Society was well known and speaking as a Cheshire man he felt it a great privilege to propose Mr Cecil Parker's election

Mr **THOMAS LATHAM** (Oxfordshire) seconded the motion and referred to Mr Parker's association with his county where the late Earl of Macclesfield and his sons were well known in connection with agriculture and also in the hunting field Doubtless it was in consequence of this that he had been afforded the pleasure of identifying himself with this motion

Mr Parker's election was then carried unanimously amid applause

The Hon **CECIL PARKER** thanked the members for the honour which they had conferred upon him It was one which he regarded very highly and he could only say that it would be his endeavour to follow the example of his predecessors, and do all he could to further the interests of the Society He thought it ought to be pointed out that for securing the greater number of the 1,239 new members who had been elected during the year they were indebted to Mr Adeane (Hear hear)

The **PRESIDENT** announced that the following twelve Trustees had been nominated by the Council in accordance with the by laws

Adeane C C B Babraham Hall Cambridge
Bedford Duke of K G Woburn Abbey Bedfordshire
Bowen Jones Sir J B Bart Council House Court Shrewsbury
Cornwallis Col F S W Linton Park Maidston , Kent
Coventry Earl of Croome Court Severn Stoke Worcestershire
Devonshire Duke of K G Government House Ottawa Canada
Greenall Sir Gilbert Bart C V O Walton Hall Warrington
Middleton Lord Birdsall House Malton Yorks
Moreton Lord Sarsden House Kingham Oxford
Northbrook Earl of Stratton Micheldever Hampshire
Parker Hon Cecil T The Grove Corsham Wiltshire
Thorold Sir John H Bart Old Hall Syston Grantham

On a show of hands they were declared elected as Trustees to hold office until the next ensuing Annual General Meeting

The Vice Presidents were elected in a similar manner, their names being

Crutchley Percy Sunninghill Lodge Ascot Berkshire
Derby Earl of K G Knowsley Prescot Lancashire
Dugdale J Marshall Llanfyllin S O Mont
Fellowes Rt Hon Sir Ailwyn E K C V O Honingham Norwich
Greaves R M Wern Portmadoc North Wales
Mathews Ernest Little Shardeloes Amersham Bucks
Northumberland Duke of K G Alnwick Castle Northumberland
Portland Duke of K G Welbeck Abbey Worksop Notts
Powis Earl of Powis Castle Welshpool Mont
Reynard Frederick Sunderlandwick Driffield Yorkshire
Richmond and Gordon Duke of K G Goodwood Chichester
Yarborough Earl of Brocklesby Park, Lincolnshire

The **PRESIDENT** then reported under By law 87, the names of the following ordinary Members of the Council who had been elected to represent the several divisions of the Society included in Group A in order that the meeting might take cognisance of their election —

Yorks North Riding Capt Clive Behrens Swinton Grange Malton
Norfolk Davis Brown Marham Hall Downham Market Henry Overman, Weasenham Swaffham

Scotland Thomas A Buttar, Corston, Coupar Angus
Hertfordshire Richardson Carr Mill Lawn, Burley, Ringwood, Hants
Cheshire: Hon John E Cross, High Legh, Knutsford Capt W H France-Hayhurst, Bostock Hall, Middlewich, G Norris Midwood, The Grange, North Rode, Congleton
Monmouthshire: Col Edward Curre Itton Court Chepstow
Derbyshire John T C Eadie, Aldershawe Lichfield Staffs
Hampshire James Falconer, Northbrook Farm, Micheldever Station Capt Percy W Seward Weston, Petersfield
Lancashire W Fitzherbert-Brockholes, Claughton Hall Garstang William Harrison, Albion Iron Works, Leigh Sir John O S Thursby, Bart, Ormerod House, Burnley
Dorset Arthur Hiscock, Manor Farm Motcombe Shaftesbury
Bedfordshire John Howard Howard, Clapham Park near Bedford
Northants Sir Charles V Knightley Bart Fawsley Daventry
Staffordshire John Myatt, Lynn House, Lichfield, R G Patterson, Acton Hill Stafford
Middlesex A W Perkin, Greenford Green Harrow
Northumberland George Grey Rea Doddington Wooler
Cornwall Brooking Trant Trethawle, Liskeard
Worcestershire Col E Vincent V Wheeler Newnham Court, Tenbury

Mr CHARLES BURRELL moved "That the best thanks of the Society be tendered to Messrs Jonas M Webb Hubert J Greenwood, and Newell P Squarey, for their services as auditors, and that they be elected for the ensuing year"

Mr CREWES, in seconding the motion said one cannot fail to observe that there is a disposition to recognise the practical principle in dealing with these matters I know the work involved in going through agricultural accounts. May I be permitted to say how extremely gratifying it is to the rank and file of the Members of this Society in the provinces that there has been such a large accession of members That is doubtless owing to the fact that in the lead we have more of the practical element in agriculture The magnetism of the practical qualities of the President, and the genial and untiring efforts of the Secretary, have been responsible for this

The resolution was carried

In response to the President's inquiry as to whether there were any suggestions to be made by Governors or Members for the consideration of the Council,

Mr H S DAINE (Cheshire) called attention to the serious loss to agriculture arising through the sale of farms and estates For farms to be sold as they were sold at the present time resulted in considerable prejudice to production It was impossible to expect the farmer to farm his best and to produce the utmost food when he had a notice to quit in one pocket and a bill of sale of his farm in the other For the duration of the war he thought such sales should be suspended, and he suggested that so long as a man farmed his holding to the satisfaction of the War Committee he should be allowed to remain undisturbed He asked that the War Emergency Committee should take this matter into their consideration with a view to submitting it to the President of the Board of Agriculture

Mr ELDRED WALKER (Somersetshire) called attention to the serious need for safeguarding the supplies of pork He could not help thinking that a very serious situation might arise if the workers in industrial centres were deprived of their bacon The position with regard to milk was also serious, and indeed the present policy seemed to be all against the small farmer and not the wealthy man Pedigree herds were selling at very high prices, and Lord Rhondda had said that those herds were to be kept up, but if all little farmers were going out, what farmer could pay 200*l* or 300*l* to get a cow back in a few years' time? The small farmer must not be wiped out

Capt Sir CHARLES BATHURST supported the last speaker's remarks as to pigs. Unless it was proposed gradually to wipe out the pig population in preference to other kinds of food, careful consideration should be given to the question whether a higher price per score should not be offered as an inducement to maintain a fair head of pigs in the country They were told there was no more valuable food in the country than fat, its caloric value was twice that of meat or bread, and the pig reproduced itself so very rapidly that he should have thought it was desirable to encourage it, especially in comparison with some other farm animals In certain districts bacon was by far the most important meat, and if social unrest was to be avoided, that was a point on which they had to concentrate their attention

Mr **Edge** said that about four weeks ago a notice had been signed by the Food Controller that milling offals were to be fixed round about 14*l.* a ton after November 15. He had looked at his bills, and had found that far from there having been a reduction, the price had been slightly increased. He made inquiries, and found that the millers and dealers had received a letter from the Food Controller stating that the Order was in abeyance, and he now complained that no formal notice had been given to consumers of the withdrawal of the Order

Mr **Arthur Hiscock** emphasised the importance of something being done to prevent the wholesale reduction of the stock of pigs, and gave instances showing how sows in farrow and young pigs were being slaughtered The discouragement to pig rearing began early in the year, when action was taken regarding the price of milk and for the regulation of prices of cheese. If farmers were not allowed to have a little for their work there was nothing for it but to let the pig go, but he was hopeful that some assistance would be given in order to save the sows and to prevent pigs from being killed in the way they had been disposed of recently

Mr. **James Falconer** expressed the hope that the Board of Agriculture would keep in close touch with the Royal Agricultural Society He would remind Mr Prothero of what had happened on one occasion when the President of the Board of Agriculture had received a deputation, and when a very large farmer asked the President to warn the Food Controller not to blame the dairy farmers of England for a milk famine in the ensuing winter He (Mr. Falconer) wished to reiterate that the dairy farmers were not responsible for what was now coming—a great shortage of milk.

Mr **Christopher Middleton** called attention to the anomalies resulting from the Local Food Control Committees having too wide powers in the matter of fixing the prices of milk. In some cases the price had been fixed below what it was costing the unfortunate retailer, and in other cases they had fixed prices which gave only a small margin and did not cover the cost of distribution The effect would be to drive milk away from many districts to others. Farmers near towns had to pay more in rent and rates, and their labour was more expensive than in the case of farmers more remotely situated If the President of the Board of Agriculture could do anything to remedy such a condition of things he would be doing a great service both to the producers and the consumers.

The **President** said that the various suggestions raised would be brought to the notice of the Council, but in the meantime he would read a resolution relating to the prices for beef and pork, which had been passed the previous day by the War Emergency Committee. The resolution was as follows —"This Committee is convinced that the position in regard to the meat supplies of the country is so grave—mainly owing to the fixing of prices at less than the cost of production for Army beef and for pork, and also in view of the threatened extension of this policy to civilian supplies - that it feels compelled to warn the Government of the serious consequences that must arise, and urges the necessity for an immediate inquiry into the whole position."

The Right Hon. R E. **Prothero**, M.P.: I can assure you it is a great comfort to me to leave the official atmosphere of Whitehall for the larger and freer air of your Society, where individual enterprise and independence has built up the agricultural wealth of this country. Sir Charles Bathurst, Mr. Edge, Mr. Middleton and others have all made certain remarks to me as President of the Board of Agriculture which I naturally shall have to pass by without an answer. I cannot at a public meeting like this say all I should like to say; neither can I in silence acquiesce in the criticisms of the Food Controller, who is a colleague of mine in the Government With regard to the question of sheep-scab arising on the report, perhaps I may say one word. I met a deputation from the Royal Agricultural Society, and I think I did tell them some facts about what we were doing which were more or less reassuring to them The fact of the matter is, we believe that scab starts in the North of Scotland on the hills, and when you come to flocks of perhaps half a dozen sheep, or often fewer, belonging to a very large number of small crofters, it is a very difficult problem. Mr. Mansell made one or two very practical suggestions which will receive our most careful attention, but what we are mainly doing is to concentrate our efforts on what we believe to be the source of the infection, and we proclaim an area up in the North and restrict the movement of sheep, as well as impose certain obligations as to dipping. I think it is a misfortune that the sheep-scab year should be treated as starting with the 1st January. Really a more convenient division of the year would be the last two quarters of one year and the first two quarters of another. That becomes important in this way. Owing to the very serious outbreaks of the first two quarters of this year and the last two quarters of last year, we shall not show a very good record for the year 1917. But supposing we were allowed to start from June, 1917, I very much hope, though I dare not prophesy, that we should be able to show a very much better result for the year 1917-18. You must not altogether judge it by the past, and we have not had time to see how far our restrictions have had any effect. But there is a marked diminution in the amount of sheep-scab in the country in the present quarter

I should like to pass to what is the object of my rising, to propose a vote of thanks to our retiring President, Mr. Adeane. With all the great changes that are bound to go on in a great war, and with all the unprecedented demands made on every side upon the loyalty and patriotism of farmers, Mr Adeane has had no easy task, but he has thrown himself into it with most untiring energy and vigour. (Hear, hear.) He has placed his time, his great ability, and his great experience ungrudgingly at the disposition of the Society. He is an admirable representative of your Society when he addresses a Government department Farmers pride themselves on meaning what they say—except perhaps when they are dealing with a horse. (Laughter.) Mr Adeane always means what he says, but more than that—and this is also characteristic of the farmers—he says what he means And although he and I are very old friends and nothing he can say can ruffle me, I have had more plain speaking from Mr Adeane than I have had from any other member of the farming community, and I congratulate the Society on their President in that respect. (Laughter and applause.) He it was, I believe, who initiated your War Emergency Committee, and it is very largely owing to his energy and initiative that the War Emergency Committee has done so successfully the work it was appointed to do. I can honestly say that on many an occasion I found that the support of the War Emergency Committee was of great use to me in carrying out the policy that I wanted to carry out

In all the financial work of this Society Mr Adeane has given absolute satisfaction to a body of business men who are very keen critics on that side of a man's work. Moreover, we have already heard that his only rival in the history of this Society as regards the number of new Members recruited during a President's year of office was the late Queen Victoria. In fact, it is a record year for the number of new Members, as compared with all the other years since the year of the Society's Jubilee. That is a great feather in Mr Adeane's cap. (Hear, hear.)

I am sure you all part with him as President with reluctance, but at the same time you all look forward to a career of the same usefulness and energy under Mr. Cecil Parker. The Royal Agricultural Society has always been particularly rich in the number of men of practical experience and administrative capacity whom it has been able to draw upon for its Presidents, and I am sure of this, that in Mr Cecil Parker we have a worthy successor to a most worthy outgoing President I beg to move a most hearty vote of thanks to Mr Adeane for his many services to the agricultural community (Applause)

Mr KIDNER seconded, and said how greatly the Members appreciated the good work that had been done by their retiring President in his capacity as Chancellor of their Exchequer Since the times of great stress, when it looked almost as if collapse had to come, the way in which Mr Adeane had thrown himself into the work of the Society had brought it to its present strong position He congratulated Mr Adeane on the great success he had achieved in a year when his office had been shorn of its most attractive features

The vote of thanks was carried with acclamation

The PRESIDENT I should first like to express the feeling I know we all have at the honour which the President of the Board of Agriculture has done us by being present at our Annual Meeting (Hear, hear) I find it extremely difficult to frame words to express my thanks to Mr Prothero, Mr Kidner, and to all you gentlemen for the kind manner in which you have received that resolution. Mr Prothero maintains his friendship with me in spite of my plain speaking I think Mr Prothero has shown himself the greatest friend of farmers because he tolerates plain speaking That is what we want We want a President of the Board of Agriculture who will be always free of access to the farmers and allow them to speak their minds

I can assure you, gentlemen, that I end my year of office with regret I have experienced the greatest kindness from all sides, and unstinted support from the Members of the Council I should also like to acknowledge the great assistance I have always received from our valued Secretary and his excellent staff

The proceedings then terminated

PRINCIPAL ADDITIONS TO THE LIBRARY.

[*The name of the donor, or the mode of acquisition, appears in Italics after the title of each work*]

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ARMSBY, Henry Prentiss, Ph.D., LL.D. The Nutrition of Farm Animals. New York, 1917 .... *Publishers*

ARMSTRONG, S. F. British Grasses and their Employment in Agriculture. Cambridge, 1917 .... *Purchased*

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FORDHAM, Montague E. A Short History of English Rural Life from the Anglo-Saxon Invasion to the Present Time. London, 1916... *Purchased*

FRENCH, Thomas E., and Frederick W. **IVES**. Agricultural Drawing and the Design of Farm Structures. New York, 1915 .... *Publishers*

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GRAS, Norman S. B. The Evolution of the English Corn Market, Twelfth to Eighteenth Century. Cambridge, 1915 .... *Purchased*

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——— Analyses Agricoles. Paris, 1912 .... *Mr. C. Adeane, C.B.*

HAINES, A. J. H., and H. **DANIEL**. Surveying and Building Construction for Agricultural Students. London, 1915 .... *Purchased*

HAMMOND, J. L. The Village Labourer. London, 1911 .... *Purchased*

HANSON, C. O. Forestry for Woodmen. Oxford, 1911 .... *Purchased*

HARRIS, Franklin S., Ph.D., and George **STEWART**, B.S. The Principles of Agronomy. New York, 1915 .... *Publishers*

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LANE-CLAYPON, J. E. Milk and its Hygienic Relations. London, 1916 ...... *Purchased*

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